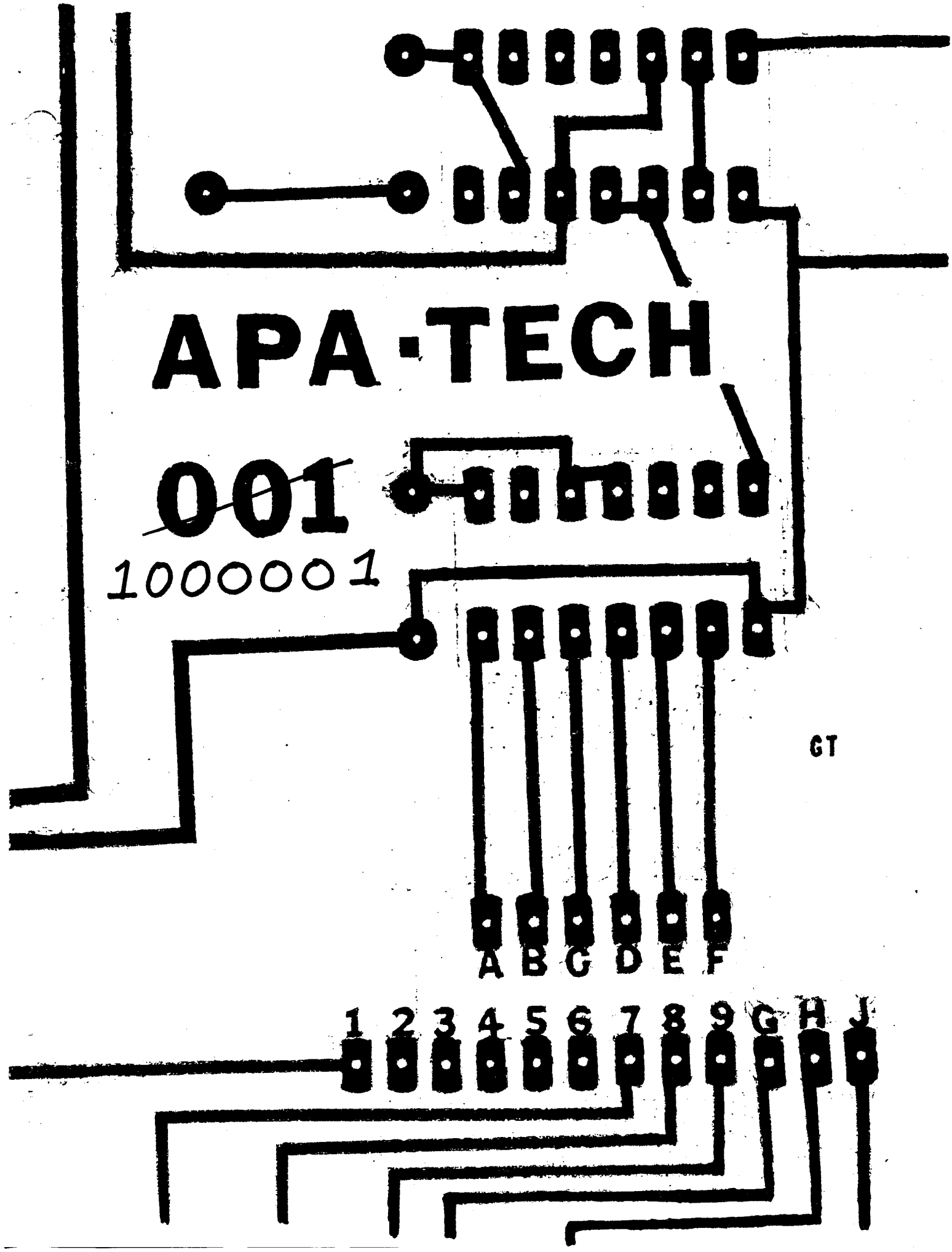

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The Amateur Press Association for General Technics

G.T. Buckfast
+ Shalmaneser

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HAPPY TENTH ANNIVERSARY, EVERYBODY!!!

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It's good to be here for the APA's Tenth Anniversary! (Goodness knows, there were a few times I didn't think we'd last this long...) I am also happy to hear from those of you who haven't written in a while. (Sorry to hear of the fire and your other travails, Dave; thank Goodness neither you nor Kate was hurt.) Traditionally, indexes for the past issue would appear here, but Finals Week just ended and I'm about to duck outta town for a while (**next** time!).

Copying will continue to be available for the foreseeable future at 5¢ a copy. I'm using the department's machine, which is well-maintained, and the operator always gets things done the way I want them (probably 'cuz he's me). If you see copies of a 'zine to me, please bear in mind that pre-collation helps...

Well, that Ruffa character will probably post-mail something... Take care and catch some rays for me!

Greg.

0f3Eb3T

coming your way from Valli Hoski of Via Gen. Guisan 21a, CH-6830 Chiasso, Switzerland and (39-2) 652374. For ApaTech, June 1989; written in May 1989. As with all issues, all rights reserved by the author.

More independent thoughts, no mailing cts as I'm not sure where the latest ApaTech is. I'd like for ApaTech to have the following although it's already been printed elsewhere.

Wrote these 2 pages 6 months ago, but the idea is still the same...

White Picket Fence Blues

I'd like to take a few lines and walk along a homebound path lined with a white picket fence.

The other morning the unlikely combination of Elinor Donahue and Amy Irving started me along the path towards a good case of the picket fence blues. This afternoon finds me musing over the paths I'e taken in life and places I've come to and where I'd like to go and why I think so fondly of a white picket fence all my own.

White picket fences are ok ... so said a lady I know in Chicago. Loosely translated this means ... I've grown up around white picket fences, made my decisions to leave, protested and marched my way with the rest, made my career and my single life, decided to share life together with someone and now it's more staid and placid than during the demonstrations, but that's ok ... I looked out my life's back door the other day and realized that white picket fences are ok.

Why Elinor Donahue and Amy Irving? Well that same morning while searching for TeleMonteCarlo and the Dan Rather Evening News on TV, I found CNN and the Sky Channel, and hence found an interview with Amy Irving (on actressing, wifing and mothering) and also an episode of the Dennis the Menace show (with Elinor Donahue as the niece of Mr. Wilson who got married with Dennis as the ringbearer.) Doesn't that explain it all?

Those mid-60s family sitcoms really created and froze a uniquely American ideal of suburban and family life. Admittedly biased and stereotypical, those shows still represent the best hopes of a generation. I think that those of us who saw those shows while young have carried away subliminal impressions of comfort, stability and honesty of those lifestyles. We might laugh and pointedly joke about the superficiality, the idealism, the stereotypes but also react nostalgically and somewhat wistfully while watching those old shows. Life sure isn't like that (and perhaps it shouldn't be) but we still are reminded of those days...

Elinor Donahue makes me think of suburbia, houses, kitchens, friends. Honestly I would probably be stultified and bored stupid as a housewife. But the homey aspects, the coziness we like to feel with the ever-ready-cup-of-coffee for friends, the knowing of your neighbors, the time to sit and talk, a pleasant view out your back door. Then the Amy Irving juxtaposition, having the career, a spouse with a career and taking baby along because babies fit almost anywhere. (I really relate to it when she says that baby Max's passport is so full of stamps that it's frightening.) Both 60s and 80s images of women evoked a strong nostalgia and yearnings in me for security, friends, family, home.

So here I am, in my 35th year, and wondering where it's going to go next. Marriage, career, life in an exotic lnd, all those good things are there. Then why do I have this occasional hankering for that suburban Oak Park life again. White picket fences of friends, stability of knowing people and them knowing you, open homes and open lives, free to stop by, share stories and advice, being with my family again and watching my nephews grow up. Maybe just daydreams but dearer than dreams they are.

A note from the viewpoint of April, 1989

Some other images have affected me strongly since I wrote that piece.

Bob Dylan said it very well in a song "...while riding on a train going west, I fell asleep to take my rest, I dreamed a dream that made me sad, concerning myself and the first few friends I'd had...with confident hearts through the heat and cold, we never thought we could get very old...and never thought that the one road we travelled would ever shatter and split...now many a year has passed and gone, many a gamble has been lost and won, many a road taken by many a first friend, I would give my life to be back there again..."

The mind's ability to capture and replay scenes, sights, sounds and feelings is incredible. At particularly evocative moments, I've closed my eyes, leaned back in my chair and I was walking down Michigan Avenue again, crossing the Chicago River with one of the greatest skylines in the world rising up around me. Or I was sitting and talking with Peter, kind of sitting that is in his kind of uncomfortable beige armchair, surrounded by his rail transportation magazines, usually discussing some railroad or other topic, anything but his personal stuff, and then I hear the El or the Northwestern going on its northbound way past his 7th floor window. Or I am at Ishercon, sitting on the stairs again, having the infrequent conversation with Mike Walsh about Seattle, and I begin to melt, remembering the exquisite nature of neckrubs. Or I am in my cousin Lorraine's kitchen, we are talking about her boys (my nephews) and why it's so difficult for her or me to get pregnant now that we are both past 30. Or even oddly enough, I am in the living room of the Frank Lloyd Wright Home in Oak Park, giving my tour spiel and I can see the details of the fireplace, the woodworking, the marvelous stairway, all again. Remarkable.

No, not necessarily all the way back there again...other discoveries...

I seem to collect friends who fit all spectrums of the rainbow. Some carry themselves best in their banker's-suited mode and others, well, are better in sweaters and jeans. There are the fellow consultants with whom I share my trade talk, frustrations and am often surprised at the insights they give to me. Then there are the engineers and the scientists who, love every one of them, keep me young with learning the wonders of their worlds, when we aren't singing "Benson Arizona" that is. And then there are the musicians, artists or simply, radicals, who take me very much into my unconventional self, for with them, life is always more intense and exotic. Every one fits a side and a part of my life and they certainly do carry themselves well. (But their differences make me realize that my values, my ideas, my actions are not as clear or consistent as I once thought. While each one is important to me, each one provides and means something different and receives a different aspect of me. Is it so shocking to realize that I need conservative and radical people?) We go gently as best we can, together when we can; gently apart, together with thoughts. Community. Don't leave home without it.

Onto more travel stories. Gee, how I wish Jamie Hanrahan was still here so someone would tell me that they enjoy these stories.

La Grand Prix: Milan/Munich

> Europe is surprisingly small for a North American. Distances become not only comprehensible but incredibly convenient. A journey of 300 miles, which would bring you between only two midwestern cities, brings you through 2 or more countries and vastly different geographic areas.

Joa and I had planned to go shopping in Munich months ago, and we trekked north in early April over a weekend. Friday night we stopped at Bolzano and stayed in a German "gasthaus" (guesthouse) that also served Italian food and spoke Italian, sort of.

> Bolzano is in the autonomous region of Alto-Adige, which still holds dear the memories of the Austrian empire with all its linguistic and cultural trappings. In fact, Alto-Adige is German in character, official language and attitude, barely ackowledging the existence of that Latin culture to the south. It is also a very industrious, prosperous area high up in the mountains. (Italy has two culturally and politically autonmous regions: Germanic Alto-Adige in the northeast and French Valle d'Aosta in the northwest.)

We continued onto Munich Saturday morning, passing Innsbruck (western Austria) on the way. In Munich we shopped, Joa for suits and shirts which are made for his body type e. I shopped for a loden winter coat, and the possibilities of shirts and skirts made in the Bavarian folk style, which I modify for office wear. The Bavarian women also seem to have the same body type as me; I can wear their wide-hipped skirts much easier than the more slender line of Italian clothing. Much about Munich pleases me: the bustling crowds, the activity centered on the city's center, the excellent trains and subways, the great shops, good beer and restaurants. The countryside is beautiful, woodsy and hilly; the Alps are further south.

> The historic buildings in the Bavarian style seem tantalizingly familiar; then one remembers why -- Walt Disney has long since introduced us to the Bavarian style of houses and buildings through his fairy tale cartoons based on the Black Forest environment of the Brothers Grimm tales. For me it is always an amusing question: did the land of Disney come first or did Bavaria?

Our return was through a rather picturesque area southwest of Munich, following the old Munich-Innsbruck postal road. We spent the night in an old postal inn, complete with sagging floors and ceilings but modernized bathrooms.

> The variety of food one finds in Italy can be limiting. Of course there is plenty of variety within the Italian cuisine from north to south, but after a while Italian is Italian, pasta is pasta and one longs for gyros, steak, tacos, anything but tomatoes, pasta, seafood, veal. Or Chinese, as Italy abounds in Chinese restuarants. Germany and France do offer a bit more flexibility for that occasional digression from their national cuisines.

South of Munich, while staying in an old postal inn, I was delighted to enjoy an excellent steak, thick, a very well-prepared medium-rare, and accompanied by traditional German vegetables. Very reasonably priced, less expensive than Chicago in fact, at about 18 DM total (say, about US$12) for a steak the cut and quality of a filet mignon. For dessert, one should travel a bit further south into Austria and enjoy their truly fussy tortes. You might never have imagined so much cream, foofarah and extravagance in a torte. You just cannot eat all that your eyes want you to, but you will have a good time trying (or else a very bad stomach-ache.) But please try the German or Austrian beer with your steak; with the torte take a good Austrian coffee.

60f3Eb3T

Dr. Gonzo's Bits ...

yet another addon for ApaTech, June 1989 via fax, posthaste, optimistic hopes etc. from Valli Hoski of Via Gen. Guisan 21a, 6830 Chiasso, Switzerland and the trusty phone secretary at (011-29-2) 652374.

The Great Jeff Duntemann Dilemma, or

why are we still mucking about with paperbased technology? (and paperbased postage?)

Techtalk for a minute. Joa and I have reached the point in our travels and correspondence where the technology that GT bantered about, a time ago, now seems timely and really relevant. Or in fewer words, why can't we have a totally electronic based correspondence? Not exactly an ApaTech on a net, but close. Every month I go through the electronic to print to mail to photocopy to mail to postbox routine in sending my ApaTech zines and receiving the printed issue. Why can't I at least transmit my zine via some electronic mode over to Greg Ruffa? Even international fax would be an improvement. What are the options? Optimally transmitting an text file via a net to Greg at the U-Minn and then receiving, ultimately, the apa in electronic form and printing it out here upon request. OK, now let's talk reality. Transmitting the zine. The zine probably exists in a computer text file. What about a net? We don't have a convenient access to a net to the US, so far as I know, not to the standard nets, such as the new version of the Arpa nodes. If Greg was in Chicago, we could try and use Bentley's machine and FIDO. Otherwise that leaves us with a file on a diskette. At this point is it really easier for me to print out the zine and send the paper? Or to mail Greg the diskette and have him print it out?Then there is the receipt of the apa. How many members these days actually type their zines? If most or all use computers, is an electronic migration feasible? If the members' zines can all be electronically based (i.e. we all send Greg our ASCII or standard text files) then the OE only need copy the files onto diskettes, adding a TOC (or would it be a VOC?). Zip, out on the next net run would go the electronic files to arrive at the member's respective mail drops. Or zip go the diskettes in the postal service. Back to reality. If the zines and resulting final product is print-based, then do I receive a printed issue via the next airmail drop? Or does the OE enter everyone's zines (or even better yet, scan them into a text file) and then mail out the diskettes? Reality currently rules that the print-based zines are photocopied, assembled, bound and mailed. In the timebound tradition of Roscoe. And so on. With some not insignificant cost to us in mailing out, repro and mailing back. Isn't there a better way, without access to a worldwide net? Perhaps fax is an alternative, especially for getting the zines to Greg. Receiving the zine back via fax could get expensive. Postage still costs less than fax for more than a couple of pages. Isn't technology great? But it's not cheap...yet.

OK, any suggestions for improving our multimedia approach (online, print, mail, photocopy, mail) to handling all our zine activity?

==========

The 'when in San Marino do as the San Marinesi do'*
EUROCON 1989

*or, the talk, pay, eat, read,
and all sorts of silly things
but ONLY in Italian

What kind of cons do you think they give in Italy? Italian ones of course. But to have a 95 % Italian con for the national European con this year? That is downright unfriendly. Enough for the fans to eat fine Italian food. And to drink fine Italian wine. And to gaze in admiration at the fine Italian ruins. But don't make them masticate the fine Italian words.

Joa and I optimistically went to Eurocon this past weekend which was held in San Marino. You know (doesn't everyone?) that mountaintop republic which is the second independent country contained within Italian borders (the Vatican is the first). So Italy accomodates all types.

Except English speaking fans, it would seem.

Let's start at the beginning with our arrival at the con. Where was the con exactly? San Marino, said the program pamphlet. Right, but where. What hotel? Hm. We had phoned the con committee in advance and made a hotel booking, but needed to either phone back for the hotel name or ask at the con. Kind of difficult since we arrived in the neighborhood at 23:00 (11:00 PM) and the hotel info desk closed at 22:00. (And we hadn't ever reached anyone at the con committee after our one lucky call.) Okay, we're flexible, we stay in Rimini for the night and will go back and try to find the con on Saturday. Rimini is

one of my alltime favorite places in Italy anyway, a great Adriatic beach resort with plenty of beach, people, boutiques, caffes and bustle to watch. Meanwhile, we arrive at our medieval town center, mountaintop and all, on Saturday and look to find the con.

About 2 hours later ...Hm, here are two likely looking folks walking down the street. Hm, they are wearing badges that say Poland, but lets give it a try. Eurocon? Do you speak Eurocon? Oh wow, a Polish fan that speaks English better than the Italians. Hm, his comment is that sure, Eurocon is down the mountain a bit, but there's not much. At least there is this nifty medieval town to explore...Hm, one thinks. And we aren't even at the con yet.

Onto the con. Held at the mm, local convention center (about the size of a small suburban library) built around the Roman amphitheater ruins. Okay, so its a cultured sf con. What is programming? A series of speeches, in Italian. There are headsets for translations, but somehow the 95% Italian programming seems excessive. How about a huckster's room? The lobby is set up with about 6 tables full of the latest from the Italian SF press. Some decent Italian fanzines. Some unusual items, like Polish fanzines, Russian postcards and buttons. Some unusual items are noted for their lack of presence, like no English or American SF, no dragons, only 1 T-shirt for sale, in fact, only 1 book in English for sale.

Programming. Best described as two panelists mumbling to each other onstage in an almost empty room. Does the simultaneous translation also include the mumbles? Hey, this is Italian that even Joa doesn't understand.

There is an art show. The local art museum has opened up one room for a nice display of a fantasy artist's renderings. Sort of fantasy and some mainstream. Sorry, but I forget the name. The art museum's real collection is more interesting, especially the 14th century hymn book and other manuscripts. They sure don't make books like those anymore. To be fair to the con though, there aren't any English books in this collection either.

There is a con banquet Saturday night, albeit $30 ticket, but this will be an Italian menu, not written or cooked in English. Appetizer, pasta, main course, dessert, coffee and wine. Actually quite good as an Italian dinner. Mostly Italian conversation. Some SCA costume activity, with the con chair, Adolfo Morganti, very handsomely attired in a black and red silk cape and such costume and a few others bedecked in the medieval gown style. Some fannish conduct, especially examplified by the Star Wars fan group who had to sit together at the banquet, never mind that there weren't adjacent tables available, making a great noise and fuss before finally settling down during the second course.

There was a film program. Full of the latest in the popular SF line, including Star Trek's Return Home. And in Italian.

What's left to say is who were the attendees. The Italians. And an interesting small mix of Polish, Hungarian, Bulgarian and Romanian fans. (Maybe not all four, but I seem to remember those four interesting countries.) Some decidedly British and American looking chaps, like Brian Aldiss who was a guest. Also possibly Fred Pohl, who I was too shy to ask how Chicago was doing. And a Dutch lady representing the Hague 1990 worldcon, but not Lynn Ann Morris or her associate (now husband perhaps) Roeloff. Unfortunate as I'd looked forward to seeing them both. And a whole bunch of American fans were obviously not in attendance, especially those fine people from General Technics.

In closing, the best comment is from Joa, who upon looking at the huckster's collection, said "but this is only a taste" of what it should be.

The best suggestion, is from Joa, and me, sort of. I was saying that perhaps only Americans and the British can give "decent" cons and Joa offered the timely comment "why don't you show them how"? Indeed, why not. Will a supporting cast come? I'll need plenty of volunteers to be go-fer fans, the fans who will truly go to the convention and show the Italians how to have a Real Con in the Best American and British Science Fiction Tradition.

Go to the Polish national convention next year in Gdansk. Charles Brown of Locus will be a guest of honor. This is a unique opportunity to see Cracow in the way that only fans know how to travel and party.

1992 The World's Rendezvou

Satellites / European Initiatives

Space: The Final Frontier For an Integrated Europe?

While the EC has already taken the first steps toward developing a Community-wide space research program, member states are still pursuing their own policies based on bilateral agreements and the European Space Agency (ESA).

The Italian astronaut who accompanies the Space Shuttle on its mission of January 31, 1991, will have a unique assignment: to go fishing in space. The fishing gear will be a tethered satellite, consisting of a high-strength line 20 kilometers long and a "bait" of instruments packed into an aluminum shell.

ESA accounts for over half of Europe's space spending

On this and subsequent missions – when the tether may extend as far as 100 kilometers into space – a variety of applications will be explored: ionospheric testing; generating electric power; shifting satellite orbits; and eventually retrieving planetary probes.

The Tethered Satellite System (TSS) has been under development by America's NASA and the Piano Spaziale Nationale of the Italian Research Council since 1982. The $100 million price tag is being evenly divided between the two countries.

TSS is not the only example of Italian involvement in space technology, however. Italians have been part of European space research from the very beginning. Sardinia was the site for the launch of the European Space Agency's first sounding rocket, Skylark, 25 years ago. Today Italy contributes more than 10 percent of ESA's annual budget of 16 million ECU ($13 billion), third after France and Germany.

The ESA represents little more than half of Europe's space spending, and not all of its members are – or wish to be – part of the EC. Italy's commitment is evident on both counts. Beyond its financial contribution, the country is confirming itself as a major-league participant in space research by specializing in key areas such as manned space stations and telecommunications.

In fact, it has a leading role among the eight countries participating in ESA's Olympus communications satellite, set for launch next month. Of the two experimental transmission channels aboard, one, Italian TV1, is dedicated to Italian receivers. The other, European TV2, is "repointable"; it can be adjusted to reach listeners in the other seven countries.

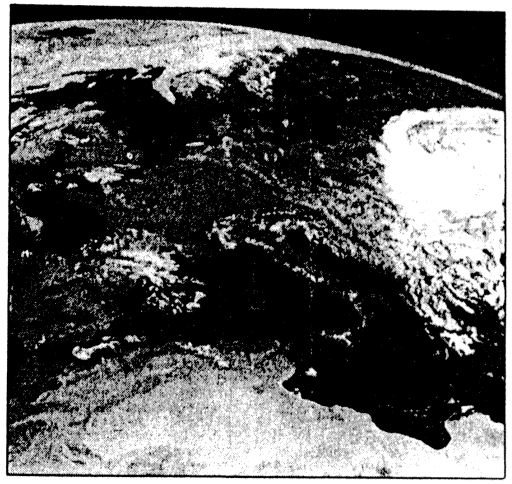
The most promising applications for a Direct Broadcast Satellite like Olympus are in the area of corporate or industrial training. The European Commission is pushing such usage, although few member states have invested heavily as yet. Olympus is also capable of meeting the sophisticated demands of high definition television broadcasting, which require advanced technologies.

Telecommunications is also high on the list of favored projects in France, which spent 8.6 billion ECU through its Centre National d'Etudes Spatiales (CNES) in 1987. About 40 percent of that sum went to ESA. Among France's priorities are rocket launchers (the extremely successful Ariane series is largely French) and earth studies, as well as telecommunications.

Of the 60 percent not channeled through ESA, French Minister of Research and Technology Hubert Curien observes, "Our faith in Europe does not mean that we consider any form of bilateral Franco-American or Franco-Soviet cooperation as beyond the pale. Such cooperation also serves as a stimulus and catalyst for the far more numerous multilateral programs."

West Germany's space budget in 1987 was 4.90 billion ECU, of which 60 percent went to ESA projects. Germany's main interests are in microgravity and the space sciences, such as planet research, black holes, etc. It has also contributed much to Skylab, is co-partner with the U.S. on the Galileo probe to Jupiter later this year, and boasts more astronauts than any other country in Western Europe.

Earlier in May, the German government approved the creation of the German Agency for Space Affairs (DARA), a non-government organization charged with coordinating and improving German efforts in space. According to Dr. Dietmar Frenzel of the Ministry for Research and Technology, DARA's strength lies in its flexibility. Its hiring and personnel practices do not have to conform to civil service regulations, so it can make decisions quickly and move staff expeditiously. The first-year budget is tentatively set at 13 million marks ($6.5 million), and up to 300 employees – tapping private-sector sources – are envisaged.



ESA

Image of Europe taken by observation satellite.

In contrast to the top three spenders, Great Britain lags behind considerably. Its national budget for space activities is less than half that of Italy's, and last year it protested its allocation to ESA, claiming its commercial return was not commensurate with its contribution.

Yet a University of Strasbourg study shows that the spinoff benefits of ESA contracts are well worth the initial investment: for every ECU invested, there is a return of three.

The European Space Agency is mindful of the fact that Britain is not the only country with a healthy interest in the commercial applications of space. Professor Reimar Lüst, director general of ESA, points out that "space technology calls for a wide range of technological innovations that can be applied elsewhere, such as in advanced avionics, information technology, robotics and new materials."

The drawback to this approach is that the most commercially appealing innovations are also the least likely candidates for cooperation. Competing companies are understandably reluctant to share their knowledge, and different national policies add to the information bottleneck. So INTOSPACE, a private agency based in Hannover, was created two years ago. Its shareholder-members are European companies that jointly develop space projects with commercial applications.

The European Community is equally sensitive to the economic and political implications of space research for both the public and private sector. The EC action program proposed last year identifies six key areas: reseach and development; telecommunications; earth studies; industrial development; legal considerations; and technology training.

It remains to be seen just how much coordination can be effected through the Commission, and how much will remain the preserve of public and private agencies. But today's widespread recognition of the need for pan-European cooperation if Europe is to stay abreast of the U.S. and the U.S.S.R. augurs well for the future.

ESA's Professor Lüst optimistically notes: "While in other areas the political will in Europe is still not strong enough to overcome certain difficulties, in space research we are fortunate. There has been a great willingness on the part of governments to see Europe play a major role. Jean Monnet, had he been able to witness

Disasters 'Я' Us

What? Yes, a zine for APA-Tech from the late great

David D. Levine
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My, it has been a while, hasn't it? Years, I'd say. But it's the tenth annish! How could I possibly miss it?

Well, there's the fire, and there's the convention(s), and there's my job, and...

OK, first things first. Back in March, there was a major fire in our apartment building. Arson, they think. Someone took a dislike to the person living right below us and set fire to their apartment. Fortunately, we were home that night with guests. I spotted the flames reflecting off the building across the alley and raised the alarm. Then we all ran out into the street, where we stood around for a few hours watching our apartment fill up with smoke and trying to understand what the firemen were saying to each other on their walkie-talkies. All we could be sure of was that there was smoke, but no visible fire, in the front rooms of our apartment.

When the fire was out, they started letting the tenants in, but not us (or the people above and below us). They didn't want to let us in until they were sure it was safe. Uh-oh.

When they finally let us in, it was pretty bad, but it wasn't nearly as bad as it could have been. My office wound up missing a window and part of a wall; Kate's office used to have a sort of sun porch, and it's just *gone;* the kitchen window was badly charred and cracked; there were holes in the walls and ceiling, there was a lot of dust and broken glass and water strewn about; and the smoke got into everything. All the papers that had been sitting out in my office (and it had been a mess) were now piled in a big dirty damp heap. (I will never again refer to my office as a "disaster area." I've seen a real disaster area.) But nobody was hurt.

Amazingly, none of our important stuff was destroyed. The computer came through just fine, despite being within ten feet of the missing window. All of our books were, at worst, only lightly smoky, and none of them got wet. We have some antiques; they're fine. The most important thing to me that was damaged was my copy of Mary Lynn's St. Liebowitz schematic. (Anyone know how much one of those is worth these days? The insurance company hasn't a clue.)

Three rooms (bedroom, living room, and bathroom) were undamaged, and the kitchen was usable after they boarded up the window and we swept up the broken glass, so we could almost live there except for the overpowering smoky smell. So we lived in a hotel for a couple of weeks, although we spent most of our evenings in the apartment. After a while, though, it was getting to be a big pain to try to live in two places at once (when we weren't really anywhere at all), so we cleaned the place

up a bit more and moved back home.

It's amazing what you can get used to if you try. We've been living in half of an apartment with hardly any windows and most of our posessions in boxes in the living room. Elves with hammers and saws occupy the apartment during the day (I assume they are elves; I've never actually seen them.) The other day I found everything in my office shoved up against one wall and completely swathed in transparent plastic. I felt like I'd stumbled into the last half-hour of *E.T.* The next day the plastic was gone and there was the beginnings of a window where the hole in the wall had been. It helps that we aren't paying any rent until the place is fixed up.

Life goes on, of course. The good news at work is that I've been promoted to Project Leader; I now have two-and-one-sixth writers reporting to me. (That's what we call Matrix Management.) The bad news is that we've had some staff cuts, so neither I nor my 2.167 writers are working on the projects that we wanted to be working on. The manuals that I would really like to write have been deemed to be lower priority than other manuals that are boring to write but important to the Corporate Image. The net effect is that I would really rather be working somewhere else, so I'm spending some of my copious free time looking for a new job.

I'd love to find a job in Europe. Any of you globetrotters have any contacts in a high-tech firm that would be interested in an American technical writer? My areas of expertise are UNIX, C, and the X Window System; I speak some French and German, although not fluently enough to translate. Depending on the assignment, I might be qualified for programming or system administration. With those qualifications, I think I should at least have a shot at a job the other side of the pond.

Of course, there's fanac too. I'm Publicity Director for OryCon 11; I'm Secretary for Westercon 43. I'm on the executive committees of both those conventions and the Board of Directors of OSFCI (Oregon Science Fiction Conventions Inc.). I'm the Secretary of PorSFiS (the Portland Science Fiction Society). In short, in matters vegetable, animal, and mineral, I am the very model of a modern major general.

Not that it's all bad. We just got back from V-Con, a small but well-run convention in Vancouver B.C., a wonderful city with *great* restaurants. It was even a *foreign* convention, with much of the charm and surprises of another country and hardly any of the hassle. Spider Robinson and William Gibson (who both live in Vancouver) were there, and I had dinner with Bob Shaw (who lives in England) on Friday night. Spider did his Heinlein Rap at the closing ceremonies, a performance not to be missed (whatever you think of Heinlein). A good time was had by all.

This all may explain why I haven't written in over a year. I hope you don't mind too much. I enjoy reading your stuff, really I do, but the deadlines just sneak up on me time after time. (In fact, I'm writing this on May 30; I'll have to express mail to make the deadline.) I considered just dropping quietly out, but how could I miss the tenth annish? I'll try to write more, really I will. See you in Boston!



— David

Gabe and Audrey's Home for Wayward Hackers

Gabe and Audrey Helou
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It's that time of year again. The trees are budding -- some are even blossoming. Time to sit out on the porch. It's short-sleeve time. Lemonade time. Barbeque time. Garage sale time. But we've covered garage sales before, so we'll talk about something else. Like travel. Travel, some one once said, broadens one's horizons. It also has the effect of narrowing the wallet. This effect is not limited to long vacations; weekends also are touched.

If the wallet drain was sudden and up front, people might travel less. Imagine filling a wallet with a stack of twenties; all the money you would be spending on an upcoming trip. No credit cards. No automatic tellers. Just cash. Take all that money and put it in your wallet. Feel how heavy it is. Try putting it in your back pocket. If your jeans are too tight, you might not be able to do it. Now remove all the money, spread it out on the dining room table and say out loud, "I'm going to give this all to strangers." If some panhandler walked up to you on the street and asked you to part with some of your loose change, you would probably tell this person to get lost, but you are about to go out this weekend and give all that money away to strangers. You are not, however, going to give them them funds all at once. The money will merely trickle out during the course of the weekend. It is harder to notice the loss that way.

Considering how much money there is to distribute of this weekend, you might be tempted to think it's easy to do -- just give people money. Nothing could be further from the truth. There are certain rituals that must be followed. Failure to adhere to these rituals often results is confused stares and muttered curses. If you approach some one in a straight forward manner and offer them money, they are likely to think you are crazy. They may even call the police. Ask a psychologist if you don't believe me.

You must look for people that are offering some service in exchange for your money and give the money to them. In return (mostly out of politeness), your must agree to accept their service. These services are many and varied. You might be offered gasoline for your car. Or a meal. Or a visit to a lizard farm. Or a tour of a house where water runs uphill. Or fresh produce. Of course, the gasoline is over-priced, the meal is lousy, the lizards are newts and the house is built on a slope. And your grocer's freezer section has fresher produce. But courtesy dictates your actions and you give money to these people.

After giving away lots of money, you return home and try to forget how thin your wallet has become. Don't get me wrong. It's not as if my fiscal habits tend toward miserly. My home is usually open to my friends as long as they keep their stay short. They are entertained and fed and seem to have a good time. What bothers me is giving all that money to strangers instead of spending it on my friends. Almost as if they are being cheated. Why buy dinner for two when the same amount of money will allow me make dinner for eight? It's enough to make me feel guilty.

So why keep doing this? Why do we keep traveling and giving money to strangers? This past weekend we did see some beautiful scenery. We breathed air that smelled of cherry blossoms instead of smog. We bought some extra sharp cheddar in a small town with a single general store. We climbed

the tallest hill in the county so we could enjoy the view and have a simple picnic: cheese and crackers. We saw some bison. We stopped in Alma for the Highland Festival -- to watch and listen to a pipe and drum competition and eat scotch meat pies.

We shopped for a kilt, but didn't buy. Maybe next time.

There has to be a next time. The thought of not traveling has never crossed my mind. My complaints about the cost will never cease, but neither will our traveling. To make up for the money spent on strangers, my friends are well fed and put up for the night. Often, they are put up for the weekend.

That's probably how the next few weekends will be spent. We've been on the road a lot lately and it would be nice to have people come and visit for awhile. If you're going to be in the area, give me a call. We can sit out on the porch with some lemonade and start up the grill.

A Change of Authors

The above was written by Gabe. I (Audrey) wrote what follows. As if it isn't obvious from the change in style.

Minicon

Over Easter, Gabe and I, in the company of Pete & Wendy Richardson and Gary and Virginia Gielincki drove from Detroit to Minneapolis. We learned two important lessons in doing so: First, don't leave early in the evening or you will arrive early in the morning...which poses a problem when check in time isn't until 3:00pm and you're there and ready to sleep at 7:00am. When we arrived at the hotel, we looked liked greasy insomniatic bums who had been sleeping in a van and had difficulty getting our rooms early...until, during our third attempt at checking in, they discovered that we were paying for our bills with gold. A Gold Mastercard, A Gold Visa and a Gold American Express card that is. Therefore, the second lesson is always carry a Gold Card.

MiniCon was a blast. This was the first Mini I've been to, and from all the fun I had, I can guarantee it won't be my last. I particularly enjoyed the costume competition and scavaging at Axeman's. We (Gabe and I) sat in on a few panel discussions, but missed all of the interpretative readings. Gabe did want to put me on a panel next year, entitled Audrey Reads, and then just have me read silently to myself (or as silent as I get, depending on what I'm reading I may mutter, giggle or laugh loudly).

Speaking of Reading...

The Troy Library seems to be my new home away from home. I've taken to going there after work about three times a week, and I've finished reading, on average, a book every other day. My most recent book was Obedience by Joseph Hansen. Before that I read F is for Fugitive by Sue Grafton, The Father Brown Omnibus by Chesterton, and Spock's World by Diane Duane. With the exception of Father Brown, all of these are worth reading.

The Father Brown Omnibus turned out to be 993 pages of tedium. It is a collection of about 60 short stories, which aren't really mysteries. I haven't been able to put my finger on just what they are, but they certainly aren't mysteries which are solvable by the reader. At the last possible second, Chesterton pulls some info out of his hat and says "well the minute I saw or heard that, I knew the solution." Which really irks me since, of course, it all makes perfect sense...but since I didn't have all of the critical data, I couldn't solve the problem. In addition, religion plays a great role in the stories (much greater than is usual in detective fiction, even taking into account the work of William X. Kienzle who's new book is out but which is so popular at the library that I haven't had an opportunity to read it yet). Also, there is a goodly amount of mysticism and the supernatural in these stories, and to which Chesterton's Father Brown repeated response is that he has no truck with

superstition, which seems to me quite ridiculous. Lastly, the collection of stories contain quite a bit of bigotry as well. Chesterton seems to share a considerable prejudice against Indians (from both India and America) and blacks.

Naturally, all this reading this cuts into my subscription magazine reading, so those are just piling up by my chair, my side of the bed, and the kitchen table.

Subscription Magazines Delivered to (and occasionally read by) the Helou Household include (but are not limited to):

- APA Tech
- American Heritage
- Computer Shopper
- Consumer Reports
- Cross Quick
- Harrowsmith
- Hippocrates
- Insight Magazine
- Publish!
- Smithsonian Magazine
- Tattoo
- Utne Reader

Audrey's New Toy

Well now I've gone and become a terror on the roads. I traded in my Mercury Topaz for a new (used) car, a Merkur Scorpio. No more waiting for traffic to clear -- instead of four puny cylinders, I now have six, and I can drive like those other nuts out there.

This car was such a deal...it was a Management Lease car at Ford, so we got it for an excellent price (about half off). Its sleek and black, and it has everything; a grey leather interior, power everything, and enough room for Gabe. Just what I've been wanting.

Today's Music

Has anyone heard any I.R.S. No Speak--Instrumental Rock for the New Age? We have Jimmy "Z" on CD and also the sampler disk "Music Too Good for Words Two." Oh, and Steward Copeland's "The Equalizer and Other Cliffhangers." I am impressed with all three, but then I like New Age. My big thing, musically speaking, is Jazz, and I find New Age to be very much like the Jazz/Rock fusion stuff I like already. Also, I am a big fan of Andreas Vollenweider.

As far as Mike and the Mechanics go, they are ok, but then I haven't seen or heard much from them since we stopped getting MTV. I liked George Michael when we was with Wham! but I am not so fond of him now, and I think his music is all starting to sound the same. He's sort of the Sylvester Stalone of the music world, in that his stuff is all very similar, and that those he influences start to look and sound just like him.

Tracy Chapman is neat. I hope success doesn't change her.

Memorial Day Weekend

Over the long weekend, we drove up to the Prudenville/Houghton Lake area to visit Gabe's mom as well as a few of our friends. We left on Saturday morning, got to his mom's, droppe d off our stuff and took off again (aren't we swell kids?). Anyway, we drove over to Cadillac to hook up with our favorite computer dealer and MTU person, R. Scott Cadwell otherwise known as Dealer. We went over to Boon to get some of their famous sharp cheddar cheese, and then drove over to some big hill where Dealer rides his motorcyles. I was scared just walking up this thing; I don't see how anyone would want to ride up it, but apparently Dealer does regularly. Personally, I'd be scared stiff of falling and dying a painful accidental death.

After munching on our cheese and crackers, we went driving and ended up talking about real estate prices, which lead to thinking about all the animals

I'd like to have if I had the money and the space, which then lead to Dealer mentioning the Bison herd in Traverse City, which then meant I'd just have to go and see them. So we did. Which explains why I now have a tuft of Bison hair (fur?) in my pocket.

Well, since by then we were in Traverse City, it sort of made sense to drive up to the tip of the peninsula to see the park and the lighthouse there, so we did that too. And I got to stand near the 45th Parallel, which I have probably done many times before, but never realized. But it was neat anyway.

After that, it was quite late in the day, so we drove Dealer back to his house, and then drove out to Roscommon to see if one of the couples we were expecting had arrived (they hadn't), and then drove back to Prudenville and spent the night with Gabe's mom (Gabe's dad is *still* in Syria).

On Sunday, we went to the Highland Festival, where we visited the various vendors present. I had wanted to purchase one of those knives that the Scotch put in their socks, but I couldn't find any I liked. After finishing our browsing, Gabe listened to the various BagPipers and I slept in the sun. After the festival concluded, we dined in Mt. Pleasant, and then drove back up to Prudenville for the night.

Monday morning we left for Ann Arbor to see Pete & Wendy Richardson and Gary & Ginny Gielincki (although as it turned out Gary wasn't feeling well and stayed home). We lunched on Salad and burgers, and then went to see "Indiana Jones and the Last Crusade." The movie was really good; it's closer to the first adventure in terms of action and suspense, and didn't rely upon screaming and disgusting scenes of insects to spice up a lacking plot.

About the Title

We seem to be operating a hotel for wayward hackers. Our best friend, a hack who we hope to be introducing to these pages in the near future, was staying with us while he was looking for work, and now that one of my friends from work (also a programmer) has quit, I have offered him that option as well. So, if you're ever in the neighborhood and in need of a place to crash, stop by!

Comments

Doug Hosto

> Welcome! I enjoyed reading about your job, and I'm glad to know you weren't involved in the oil rig explosion/fire.

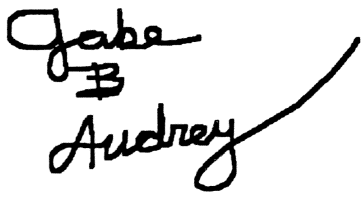
Donna Proni

> Congratulations on becoming the Crime Prevention Volunteer of Michigan! And, it's very nice hearing from you again!
>
> p.s. Hope to see you at Bob & Connie's later this month!

Bill Higgins

> I liked your Weasel Rats. I mean I like the concept. I mean I've also been victimized by those vicious weasels. Oh, never mind.

Bye for now!



There's No Place Like Home

Bonnie Jones
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I have been looking forward to the tenth anniversary of Apatech for several months now. I inherited some back issues from Keith Thorne, member #1, including issue #1. There were eight members in that first issue: Mike Bentley, Alice Insley (Bentley) and Keith Thorne at one address at the University of Illinois; Alex Ellingsen, Renee Sieber, and Tullio Proni at one address in Kalamazoo; Michael Sestak in Texas, and Dick Smith near Chicago. Renee was the editor. The first edition included a statement of purpose, definitions, rules, and biodata, much of it in repro blue. (and lots of computer talk! I should have known.) I thought one of the more interesting items was that Alice considered herself a non-technical person. The first cover was (of course) a simple circuit board. The second issue boasts of 13 members and the editor was already screaming for covers.

I remember being asked to join GT, by Alice (we went to Lane Tech High School together, along with others many of you know) but I was not a joiner, and a little overwhelmed by these people who were obviously smarter than I was because they knew about computers and science and stuff like that. I went to Windycon 3 with the science fiction club from Lane, but lost contact with these people when we went to different colleges. I didn't get involved with GT until I met Andy Anda at Northeastern Illinois U. in a science fiction class, and started going to conventions again. So, ten years ago, I was just finishing my first year of college. Hadn't decided on a major yet, I was taking a little of everything. I wanted to save the world, or at least my little corner of it, so I signed up with the Geography and Environmental Studies Dept. Geography was interesting, and cartogtraphy was easy, after drafting class in high school, so that is what I pursued. And here I am, making maps for children, possibly influencing future generations. A worthy profession.

Now, how about the title of my APA. Well, if you remember my last contribution, (I think it was in December) I mentioned Sam and I bought a house. Here are the details, finally! The house is a typical Chicago brown brick bungalow built in 1927 by my father's parents. Dormers were built on the second floor for an apartment in 1939. The first floor has three bedrooms and the house has a full basement. Got that? Okay.
A few days before Sam and I were going to take a two week vacation in November, my father asked me if we wanted to buy his parents' house. Dad had bought it from Grandma

after Grandpa died because she didn't want to take care of it. She got herself a two bedroom apartment and lived on her own until last year when she died at the age of 92. My brother and his girlfriend (now wife) lived there for four years until they bought a house. Then it was rented to a couple who turned out to be related to Sam.

Anyway, the couple who lived on the first floor were moving out so we could buy it from Dad and live on the first floor. We had talked about renting it but didn't want Dad as a landlord. Our only problem was that after looking at other apartments, we had just renewed the lease where we were living. ~~So we held a gun to our landlord's head~~ We explained the situation to our landlord, and we agreed to keep paying the rent while the place was vacant, which turned out to be two months.

That weekend we looked at the house, (Sam hadn't been in it before) talked it over, worked out a mortgage with my folks, talked to a lawyer, and started packing. We spent our two weeks vacation packing and moved in the last weekend in November. I had wanted to go someplace warm for vacation, and the new house does have a themostat. (Yeah!)

When I got back to work, my co-workers asked what I had done on my vacation so I told them I bought a house and moved into it. You should have seen their faces. Two of them had just spent 6 months arranging to buy houses and I had done it in two weeks. We signed the papers on my birthday, January 7, 1989, and are now in debt for more money than I can comfortably imagine.

I want to apologize for not writing for so long, but I have been working nine-hour days since the third week in January and ten hour-days since mid-March plus a couple of Saturdays trying to finish the atlas. The end is in sight. Our tentative print date is July 6.

Something really weird happened last weekend when we were at Rolf and Mary Wilson's for Thanksgiving. (Yes, that's right.) The conversation got around to houses and finances, and it struck me that we all actually own houses! Does this mean we are all grown up now? Well, I'm not! When I was young(er), I decided I would be an adult when I had my own place to live, a job, a car, and a boyfriend. It follows that since I have never owned a car, I am not yet an adult. So there!

Guy: I wanted to mention that I liked the short story that appeared a couple of issues back. Try getting it published.

Bill: What about automated houses, especially kitchens? I could really use one.

Valli: If you think nudity provokes interesting reactions, try not shaving your legs for a couple of months and then going out in public in shorts or a dress. I am trying it as an experiment. I hate shaving. I get ingrown hairs if I shave, which itch terribly until they grow out. I don't shave in the winter and now that it is spring I am wearing shorts and watching for reactions. I haven't had any comments yet but it is still early and I am being rather timid about it. The hardest part is fighting myself. I guess I worry too much about what other people will think of me.

Annette: When I was in 4th grade we took standardized tests. Out of 80 students, my best friend Anna and I took first and second place in reading and math.

For some reason, my family has always assumed I was mechanically inept, so I was. Is this true now? Only if I don't try. Nobody is good the first time they try something, but of the things I have tried, I'm pretty good. It was just that nobody took the time to teach me. If someone tells you are stupid for long enough you start believing you are stupid.

You have experienced bias your whole life. You are female, short, wear glasses, whatever. Everybody has experienced bias for all kinds of reasons, it is an 'us and them' mentality. We put you down so we can feel superior. You are going to have bias the rest of your life. You have to learn to deal with it. Sure, other people can sabotage you in various ways but they cannot make you do poorly in tests, or make mistakes in papers. But you can do that to yourself if some part of you believes the bias to be true. You are a capable, intelligent, attractive person, not a statistic, and certainly not average.

Intimidation - someone you respect puts you down. You either accept this persons opinion as valid and let it direct your life or you realize that this person is not a god, but a human being that makes mistakes in judgement like everyone else.

TRANSPORTER TOPICS

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It's White Rabbit time, again. Are you sure May has 31 days? This month has just flown by! Oh, yeah; how do you like my new printer? It is a Hewlett-Packard DeskJet. I had to sell a rifle to pay for half of it, but am very pleased. There have been two problems; first, the cable the computer store gave me with the printer was not only the wrong gender on one end, it was wired for IBM standard. When I plugged it in with an adapter, the cable crashed my computer! Not even the "caps lock" light would come on. Well, I have the correct cable now. The other problem was that the manual lied about how many lines per page to set my word processor for!

Mailing Comments

Dr. Gonzo: Speaking of music, did it occur to you that at least two of last year's biggest hits were sixties revivals? "Got My Mind Set On You" and "A Touch of Grey" were both in that style and were performed by people who first achieved fame in the sixties. There were other examples, as well. Maybe Rock will get back to its roots. * Write more! *

Vadose Zone: Welcome to the APA! * Sounds like an interesting job (in the sense of the Chinese curse). Actually, "mud logging" sounds like it involves cutting timber in a rain forest. *

Murder News: Welcome back, Roxanne. * Re. Yr. disk problem: I know the feeling. * Whew! You've done a lot of travelling recently! And more to come! * I have known gamers like that. They are generally placed in a category called "getalife." * I suppose you know by now that, shortly after Emperor Hirohito's death, we also lost Osamu Tezuka. * Re. Yr. Cmnt. Me on Kentucky: I'm afraid you're right about the people here. Sometimes it seems that every third person from KY is a jerk. Even those who aren't may offend through their archaic attitudes. They think they are being courteous or gentlemanly by "helping the lady." * I have heard from other sources about pets carrying poison ivy. I tend to have no problems with the evil weed except when working for my Mother. *

Crumbcrunchers: Too many people seem to assume that their children are normal, and don't need checkups, vaccinations or other medical care. I have seen the same phenomenon in pet owners. It isn't a matter of neglect, just an attitude that there is no reason to bother. * Did you know that the Teenage Mutant Ninja Turtles started out as a comic book parodying Marvel Comics X-Men? They were so popular that other writers began copying them, resulting in parodies of a parody! They have been made much mellower for the TV show. * Re. Yr. Cmnts. Me: The felines are fine, except that I believe that Taffy is going senile. He has been acting even stupider that usual lately. Want to borrow a brain-damaged, half-blind, over-weight cat who is a hunting fool? Or, you might try some of those "rat motel" traps, which are basically larger versions of the "Roach Motel" concept. *

AstroTurk (Is this an updated version of an old Japanimation series?): I have had many encounters with the weasel rats. For instance, I will use an idea in a game adventure, only to have someone say "Oh, you must have read such and so," when actually I have never heard of the book/short story they mention. * Actually, there are commercial hovercraft which carry passengers and cargo, as well as military versions used for landing craft. And irradiated foods are not safe, since the amount of radiation needed to sterilize food also creates unhealthy levels of free radicals. * Yeah, NASA is too much hype and too little substance. They should have let the military program continue with the second-generation X-15, instead of concentrating solely on missiles until the shuttle. Nothing like a good combination of professionalism and practicality to get the job done. *

The Other Guy: It could be that fusion has never been reported when hydrogen is diffused through palladium in vacuum physics because no one thought to look for it. Check and see if any of these measurements have had problems with excess heat from an unknown source. Also, using palladium rods instead of foil could be an important pre-requisite. Most foil is made by pressing bar stock through rollers. This would tend to distort the crystal matrix you feel is so important to the fusion process. If you <u>are</u> right, adding a moderator to the palladium or the working solution should increase the reaction, and make it start sooner. *

Donna: I was supposed to be the Neighborhood Watch coordinator for our neighborhood board of directors, but the board just sort of fell apart a few months ago. I got the job when a neighbor nominated me at a meeting, saying "You're a law and order type of person." I countered this with the statement that I was an anarchist, but they gave me the job any way. * Successes of the sort you mention show that neighborhoods <u>can</u> be cleaned up, if only the people will pitch in and help with the effort. Unfortunately, too many would rather have something to

complain about. *

Knowledge is Dangerous (Greg): I am currently running both air conditioners to cool the house enough to sleep tonight. It hit ninety today. *

Updates

Two weeks after sending me a copy of their submissions guidelines, Amazing returned my manuscript with a note saying that they no longer accept unsolicited materials. Huh?

The new car is doing great. However, I do have a few minor quibbles. The fancy electronic tuner on the radio is slower than the mechanical unit in my old car. Previously, the radio was on station as soon as the button hit bottom. Now there is a noticeable delay between the time I push the button and when the new station comes up. Something similar is happening with the electronic fuel injection system. There is a slight lag on acceleration, and a more noticeable one when letting up on the pedal after revving.

My game module has been delayed at the printers twice, and is now expected back in early June. It has already been advertised.

As noted at the beginning, this crept up on me. Therefore, I am sending it in with a bit less than three pages. Sorry about that; I had hoped to do better for the Tenth Anniversary Issue.

Help, someone's eating my nose!

Rolf Wilson

It has been a long time. I looked over some time that I had been meaning to send in some time ago. It included the news that Mary was pregnant. Well, she isn't pregnant any more. Our son Anders is over 7 months old. Perhaps this explains why we have been too busy to write...

My average day begins somewhere between 5:30 and 7am. I used to be a night person. If Anders is sleeping, I may quietly sneak over to the Y to get a little exercise and sit in the whirlpool. Jumping into a hot whirlpool has proved to be good method of jump-starting me. I take care of Anders until 7, when I have to get ready for work. Since Mary has been working until 11pm, this means that she gets less sleep than I do.

There doesn't seem to be much that we can do about that. Mary takes care of him until 2 (if she is lucky, he will take a nap) and leaves him at a daycare. I pick him up before 6pm, and take care of him until he goes to sleep somewhere between 8:30 and 9:30. The time after this is mine, but I can't leave the house, and I have to remember that he may be up at 5:30...

The biggest change is that only one of us is there at any given time 5 days a week. It can be tough not having a backup, even for 5 minutes. Anders can be quite a task. At the age of 6 months, he had already been thrown out of 2 daycares. But he is quite a lot of fun, too. All it takes is one cute baby (independent observers say that he is cute) to turn a bunch of adults into total fools.

As some of you may or may not know, I work at the Illinois Geological Survey. One of the things we do is use a geographic information system (GIS) and various information to help in the siting of various things. Champaign County spent $300,000 on studies to figure out where to put a new landfill. Then it turned out that the site they chose was over an important aquifer. If you dumped waste there, toxins would leach into the water supply. So the county came to the Survey for help. I wanted to know if they had used computer mapping methods. Yes, but they had not put sufficiently detailed information in. I said "sounds like the worst case of "garbage in -- garbage out " I've ever heard of!"

One of the other things we are supposed to site is considerably harder. Illinois has to come up with a disposal site for low-level radioactive waste. Various areas can be ruled out because of earthquake hazard, or underlying sandy soil where any leaks would spread easily. Run it all through, and you get a map of possible sites. However, every county in the state has rejected it. They are still working on one town, which is willing to have it even though the county objects. But a disposal site is mandated by law, and one will be built no matter how much someone objects. Many people are willing to live without nuclear power. But how many would give up all the medical uses that use small amounts of radioactivity?

Someone at work had an interesting map. It was the US, with all the individual counties shown. He was shading in every county he had ever been in, even if it was just passing through on a highway. Another color was for counties he had lived in, which was quite a few while he was in the Army. I suggested a third color to show places you had actually had as a destination, to stay or visit, not just pass through. Think about it. Producing such a map requires you to drag out old atlases, check rail routes, remember old shortcuts and trips. In other words, a great deal of fun. Since I have such great mapping facilities at work, I produced a large map like this. Not for me -- for Anders. Everywhere he goes, I will mark on it. One day, he may treasure this. On the other hand, he may not care.

Quick book review -- The Chantry Guild by Gordon Dickson. Hal Mayne puts the war on hold for a couple of months, goes around in circles, and comes back. Nothing really happens. Yawn.

Recently, we got an actual guest bed. Real mattress and everything. So, visitors no longer have to sleep on the couch or air mattresses. What a concept.

Had our annual Thanksgiving dinner late in May. A few people made it in from out of town, like Jerry Corrigan, Bill Leininger, Mike and Alice, Kirin Wagle, Sam and Bonnie. I was depending on the grapevine to get the word to some people in Chicago I could not get in contact with. I got news for you. The grapevine in Chicago is dead. Only about 30 people showed up this time.

Capitol Crimes

Re D&D -- I never got into any 24-hour D&D games, but I remember some 12-hour stretches. Of course, I was around 17 years old at the time. Now I DM a group of people at the local games

tournament, WinterWar, once a year and have a great time. I know at least one marriage that broke up with "excessive D&D playing" as a major cause. Anything to excess...

Re smoking -- I seem to remember a recent report that said that society now has a different view of smoking. It has become associated with the poor and uneducated. An anti-status symbol. Various parts of the country are different, but here in a building of 250 workers, I can only think of one person who smokes. Almost no friend of mine smokes.

Crumbcrunchers

Re computer adventure games. I have given up buying them for the most part. I tended to get very involved in them, and spend hours at it. When I got Planetfall, I spent 20 hours one weekend on it. Then I had solved it, and it was no fun any more. It just seems to be how I think. I get involved with one problem, and want to solve it completely. Sadly, this means that if no task at work is interesting, I may start thinking about some project that has caught my imagination at home.

Re Martin Beck. This series of "police mysteries" was written by the Swedish husband and wife team of Per Wahloo and Maj Sjowall. Wahloo died in 1975. The "o" in Sjowall and both "o"s in Wahloo are supposed to have 2 little dots above them. Despite owning a Macintosh, I can't seem to find that character in Times Roman. I could edit a font for use on the Imagewriter, but I don't have a utility for changing PostScript fonts.

1	Roseanna	1967	translated by Lois Roth
2	The Man On The Balcony	1967	translated by Alan Blair
3	The Man Who Went Up In Smoke	1969	translated by Joan Tate
4	The Laughing Policeman	1968	I don't have a translation
5	The Fire Engine That Disappeared	1969	translated by Joan Tate
6	Murder At The Savoy	1970	translated by Amy and Ken Knoespel
7	The Abominable Man	1972	translated by Thomas Teal
8	The Locked Room	1973	translated by Paul Britten Austin
9	Cop Killer	1975	translated by Thomas Teal
10	The Terrorists	1975	translated by Joan Tate

I first read one of these books in my Scandinavian class, and liked it enough even in my poor understanding of Swedish to want to read them all. I don't know if they are in print right now. I suspect not. I recommend these books highly.

Weasel Rats

Sorry I could not make it to the space conference. Ruth Ann and Helen Parker have made it clear to me that it was well worth going to. When Anders gets to a certain age, I will be willing to take him with me and go somewhere for a weekend even if Mary cannot come. I don't know what that age is. It isn't here yet.

Cold Fusion

Most of the experimenters have been unable to duplicate the cold fusion experiments because they have overlooked one important detail -- the coils cannot be immersed in ordinary water. You must use polywater...

Information Explosion

Welcome to the world of Unix! Or perhaps I should say MORE UNIX ! GREG. I don't worry about computer viruses much, having taken the precaution of installing some public domain virus checkers. They one drawback is that one of them keeps popping up every time I use my C compiler. It sees someone attempting to ALTER A CODE SEGMENT and gets very worried, and I have to reassure it.

As for E-mail, if you get on BITNET, I can be reached at ROLF@UIUCDENR.

Actually, it always seemed to me that the creators of computer viruses have made them do the wrong sort of things. I think a computer virus should slow down the clock speed of your computer, overheat the disk drives, reprogram your sound chip to make coughing noises -- and go away in 24 hours.

Re children's toys at Ishercon. Of COURSE the techies will play with them!

Moving What a Concept
OR
How I Got From There to There

a low tech zine from: LINDA MATSUSHITA

Well, months have gone by and I've been mostly busy doing nothing. The Move was surprisingly smooth. It was a lot of hurry up and wait, but not too bad. Once paperwork gets started, it takes on a life of its own.

About a month before we left, we had everything (almost everything) shipped. The movers came and packed the entire contents of our apartment in 5 hours (plus 1 hr. off for lunch). They even labeled the boxes - in English! They packed extremely well - the only damage was a small piece broken off of a small knick-knack. We weren't able to bring our electrical items, though.

The juice out of the wall is 100 V in Japan and 120 V in the U.S., so we would fry the Japanese components. Also, the TV + FM frequencies are different, so the tuners wouldn't have anything to receive here. We did bring our Nintendo and kotatsu (imagine a large coffee-table with a heating unit on the underside).

The Nintendo is not at all compatable with the unit marketed in the U.S., but we have quite a few game cartridges, many of which are not available here. We also have sources who will send us more games. We have yet to locate a power converter. The best we've found is a shop who will custom make one for about 200^{oo}. Any one know of a place selling step-down converters?

After shipping everything off, we moved in with Yas' Aunt & Uncle in Kobe. We tried to keep our

luggage to a minimum, since we also had to transport Sasha, the cat. Yas was still working, and had to commute 2 hrs each way. I wasn't working, and so was able to lead a life of liesure. I was furiously working on a Japanese craft called oshie (pronounced ō-she-ā). It's a raised picture made by layering fabrics. A woman in my apt. bldg. teaches the craft, and I had been taking lessons for about 3 yrs. I wanted to finish my final project before leaving Japan. I did, too.

One weekend we met Yas' parents + sisters at an onsen (hot spring spa) between Tokyo and Kobe. We had always planned on going to an onsen, but never managed to get there, so this was our last chance. It was great, and I wish we would have gone more often.

The onsen had indoor and outdoor segregated bathing pools. And the water was HOT. In Japan, bathing is raised almost to an art form. There is a very strict code of behavior to follow. Most obviously different from Western custom is that the bath itself is for soaking and relaxing <u>after</u> you are clean. The water must remain clean at all times, since everyone uses the same water. This is true in a private home or in public bath houses, which are still very popular.

So, first you must wash thoroughly outside of the bath - similar to taking a shower. This is also somewhat different, since you shower sitting down. Now you're ready for the bath. Although most public baths are big enough, one should never swim or float in the bath. Also, because the water is so hot, it is not recomended to spend more than 20 minutes in the bath.

Blood pressure tends to drop and people have been known to pass out.

Since you are paying big bucks for the privilege of taking a bath with water that's heated by nature for free, it is customary to take several baths a day. A typical scenario might be: wake up - bathe - breakfast - bathe - tennis/golf - bathe - lunch - bathe - hiking - bathe - dinner - bathe - mah jong - bathe - sleep. That might seem a bit extreme, but most onsens boast some therapatic value due to the minerals in the water. So you'd want to spend as much time as possible deriving the waters benefits.

The onsen we went to was up on a mountain, surrounded by forest. We could see Mt. Fuji from our rooms. The indoor bath had a large picture window overlooking the outdoor bath and a lovely forested mountain-side. It was January and the temperatures were around the freezing point, but there wasn't any snow. Both baths were in use — after being in the hot water you really don't feel cold. There's a primordial satisfaction in watching a night sky, listening to the sounds of a forest, and being embraced by water.

All things must end, and so did our trip to the onsen. Back to Kobe we went. The next week we would be off to Tokyo and the American Embassy. On Jan 31 at 9:00 AM we had an appointment with the Powers That Be. If you miss your appointment, They will not consider <u>any</u> VISA application for you for one year. I woke up at 5AM that morning with a fever of (at least) 103° and stomach flu.

I kept telling myself that I wasn't really sick - mind over matter and all that. I was almost

convinced until I nearly passed out in the train on the way to the Embassy. It was the hight of rush hour - in Tokyo. Need I say more? Of course being January, all the windows were closed. I was beginning to feel very warm and somewhat claustrophobic. Lieing down seemed like a good idea, but there was no where to fall. I tried to anyway. A very kind woman gave me her seat (a small miracle in itself) and I managed to stay with the concious. We reached the Embassy with no further major mishaps.

As with all bureaucracy, it was a case of long lines and long waits. They can be late, but you can't. We spent 3 hours there, but I'm not really sure what happened. I found a nice unused corner, sat down, and fell asleep. Yas woke me whenever They wanted our presence. Basically, we just gave them all the forms, documents and monies required and They gave us a sealed packet that would self-destruct if opened by anyone other than an immagrations officer.

After a week in Tokyo, it was back to Kobe. We decided to leave from Osaka Airport instead of Narita (near Tokyo) for several reasons, among them Osaka is less hassle to get through and is easier to get to. The omens were favorable - it was raining. Rain at the beginning of a trip is a good omen in Japan. Cleansing and purifying and all that.

Unfortunately, Sasha couldn't fly in the cabin with us. The airline assured me there was a heated and pressurized compartment for pets. We had a fairly large travel case, furnished with all the

necessities. Although I don't think he ate any of his food during the flight, he came through it pretty well. After going through customs, we were able to let him walk around a bit. We were afraid he would be comatose, but he took it all in stride.

Motorola had set us up in a Ramada Hotel. The place was falling apart in stages. We were all anxious to get out of there ASAP. Even Sasha - he hated being disturbed by the maids with their industrial vaccums. They also sent us to a relocation company. On our third day of apt. hunting we settled on one. They all really were pretty much the same, and we did want to get out of the hotel.

We're in a nice area on the north side of Phoenix. It's very quite and away from the main city - almost suburban. We have a 2 bdrm / 2 bath apt. We've estimated it's more than twice the size of our apt. in Japan. The rooms are pretty empty because we have only the furniture we brought with us. We're planning to buy a house towards the end of the year, so we don't want to buy furniture for the apt.

Time and paper are running out. Sorry — no time for M.C.s this time. Catch y'all next time.

Linda

Parenthetical Perambulations.

nth in a series of zines from ANNETTE KAVANAUGH
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IN THE BAD TIDINGS CATEGORY . . .

For those who have no heard the bad news from me or Andy, the the two of us are splitting up. We separated (i.e. I moved out) on the 15th of March or thereabouts, and as I write (9 June) the divorce proceedings are underway. (This by way of explaining the change of address in the last issue.) It is a reasonably friendly brteakup, if anything of this sort can be called friendly; anyway it's amicable in the legal sense, so the lawyer has next to nothing to do. We took care of all the sordid details of dividing property without having to take it to court. Anyway I should close this note with thanks to all the people who helped us both through this most difficult time, including our families and mutual friends. Special thanks to Bill Higgins and Greg Ruffa for their moral support, (and to Greg, and my fellow graduate students Guy Bernard and John Merkel, for helping me move).

MORE DISPATCHES FROM ACADEME . . .

As a result of the above personal tragedy, I did not pass the tests. In spite of my adviser's threats, the department did grant me one more try, for this fall. I passed the test for which I had studied for two or three days, and missed passing (by a mere 8 points) the one to which I had devoted the better part of the preceding three months. (This loss of points resulted from going blank on some stuff I have known for more than 10 years. Such are the wages of stress.)

Because I did not pass the tests, the department sent me a nasty letter telling me that NO summer teaching was available for me, so I went out and looked for other jobs. I found a

really good one, teaching basic math to public policy students; it pays more than a summer appointment with the math department involves less time per week, and boasts as perks an airconditioned office and respectful treatment. (In the Minnesota summer, the airconditioning is nothing to sneer at, and my battered morale could certainly use a little respect.) Funny thing--in the math department I'm treated like a galley slave, but outside it, almost without exception, I am viewed with some awe as an apprentice in an arcane art.

Somew weeks later, the math department in Its ineffable generosity changed Its mind and decided to offer me as summer teaching job, which I had the unspeakable pleasure of declining. I am told that this sort of thing is pretty much standard behavior, and the other TAs don't seem particularly put off by it; but I violently object to mind games and the expectation that I'm supposed to sit still for this kind of abuse. (I also resent losing the time from study looking for a job, but not so much, considering the outcome.) Furthermore, I find that my department has a reputation as a snake pit not so much among its TAs but among undergraduates in all departments and graduate students in other departments.

Enough puffing and hissing. On to the mailing comments . . .

APA-TECH No. 64

VALLI: I should confess (is blush required?) that at the advanced age of 28 I have not yet been to a rock concert. . . howevercomma I found your remarks on synthesized wind instruments most intriguing. If you run across more detailed descriptions of such, please frank (or summarize) them as yours truly is most interested. . .

ROXANNE: Re your trip to Europe: O major greeneyed envy! Especially for the battlefield tours. . . in days of yore I was an amateur military historian and still would auction

off a younger sibling or two for such an opportunity. Bruce sounds like a very interesting person.

When I was at University of Chicago I knew a few people who were "into" D&D . . . they seemed to me to be a strange obsessi subculture, mostly because I hadn't taken an interest in such things for a very long time, and because the sorts of scenarios they played out seemed dreadfully hackneyed. Sympathies for how things went in lieu of Ishercon.

Definitely agree with your comments on alcohol use. Living nea a campus with a large fraternity contingent, I do not feel safe walking home alone on Friday and Saturday nights, at least in part because I'm worried about intoxicated drivers. It's only been once or twice that I have crossed paths with herds of intoxicated (male) undergraduates, but understandably such encounters make me a tad nervous.

Re taking over a university someplace: Three GTers at University of Minnestoa does not a coup d'état make. . . howevercomma Greg & I have spent many pleasant hours being intensely disgruntled about the general state of things and fomenting revolution. Perhaps we should start a math & physics commune and rove the countryside looking for recruits. . .

The real problem (or a significant subset of it) is that teaching has extremely low prestige in this culture and God only knows what to do about that . . . had I paper enough & time I could write a respectable tome on that problem and its relation to the low prestige e.g. of raising children. . .

On the "Old Girl" network you suggest: such a thing already ex ists somewhat in the mathematical world. Since we're all p pioneers, distinctions of rank do not matter as much, and there are a few women who've acquired enough stature & clout in the math subculture to be able to go from place to place being advocates for the interests of their younger sisters in the profession. Re networking in sororities: I get the impression from some of my younger (i.e. 18, 19-yearold) students that

more of this goes on now than used to (of course, Minnesota is in some respects a fairly progressive campus, so I may not be entirely correct if I extrapolate from this to the national scene). Still, there's a lot of sophomoric nonsense that still goes on; I suppose that that can't be helped, since fraternities and sororities exist to serve the herd mentality.

R. SMITH: Congrats on the new car! I too have a new car (well, new in the sense of newly bought). It is my first, and no doubt will initiate me into the ranks of adults (i.e. it will give me reason to kvetch about the doings of its persnickety innards, kand thereby provide me with readymade conversation.) I bought it outright (no car payments!). It is a 1980 VW Rabbit (from Texas and thereby maximally rust-free) with manual transmission . Quite irrelevantly, it is light green.

Re envy at the conversation in the car dealership . . . Last year I had an officemate who was three years younger than me (ie, 24) and who had published three or four papers on partial differential equations. What's more, she was a VERY nice person (which made it really tough to dislike her: envy yes, dislike no). I subbed for her, teaching, when she had to fly back to Italy for a week to take care of some bureaucratic emergency, and upon her return she paid me off with a kilo of chocolate. (ye gods).

Re viruses: I do not understand the mindset of the sort of lowlife that turns these things loose in the world to prey on the unwary, but concur with Greg about their approximate rank in the order of malefactors. They strike me as at once unprincipled, arrogant, and supremely careless.

What does RAEBNC mean? (I do not entirely speak the local lingo.)

Apologies for ambiguities in the 4D creampuffs cartoon. . . what you saw was a first draft. The wages of studenthood are having to do a half-assed job of everything.

I definitely agree that most teachers train instead of teach (one, it's easier, and two, it's less likely to be taken for subversion). However, I must say I am not convinced that intelligence is necessarily a survival trait THESE days, either

BILL: Very nice discussion of space flight as Special Event vs. mundane routine, . . . and very much enjoyed hearing you on the panel at Minicon. Major condolences on having your brain burgled by the Weasel Rats. . . howevercomma I am passing on your apazine summary of "Lost Futures" to my friend Guy Bernard at work. (Last week or so he asked me about why we don't have aircars). So you will have a slightly larger audience (by an increment of one). Guy is a very entertaining character (and he'll be coming to Chicago with me the 4th of July) so I'll tell you a bit about him: he is French Canadian, in his late thirties, and a math graduate student; like other foolhardy people we know, he left a good civilian job (in mechanica engineering, in his case) to pursue the academic muse. I have acquired an undeserved reputation as a repository of obscure facts because on several occasions Guy has asked me off-the-wall questions such as "Why did the Roman Empire fall?" and "What causes cancer?" and I've been able to supply, if not an answer, then at least a guide to the more reputable conjectures. When I introduced Guy to Greg, he asked him to explain physics (!), rather an ambitious task for the course of an evening's c onversation.

GUY W: Interesting animadversion on the "cold fusion" thing: which has been a cause of much conjecture, gossip & debate up &down my hall at work (even mere mathematicians take an interest in such things.) Dis much enjoy talking to you at Minicon about things that go boom, and hope I'll be able to make it to the Houghton berserker for more of the same.

DONNA: Congrats on your award! I can see why you got burned o out on the apa vs. your volunteer stuff. There's really no competition between seeing f.rsthand that you're making a difference (and getting comments from others to that effect) and doing something that people pretty much take for granted. Glad to see you back in the apa as a contributor, and hope to see more dispatches from Kalamazoo.

GREG: Re your second franking("Burn the buildings; hang the professors"): I ran across the book therein reviewed some weeks ago in Dalton's, and in spite of the inflammatory title it seems to be a fairly trenchant critique of What Is Wrong with Academia as we Know It. Interestingly enought the review you franked did not mention some of the more "controversial" abuses Sykes takes on: pseudoscience in the social sciences an sexual harassment by professors, to name but two.

APA-TECH 63: will have to wait. I am pushing the deadline as it is. Hope to see some of the Chicago cr d when I am there over 4th of July. Until then. . .

PS: thank you O noble soul who supplied a cover for this issue & thereby saved me from having to be creative in the midst of exams; my gratitude is of arbitrarily large size.

Hopes for nuclear fusion continue to turn cool

- Press conferences continue
- Verification mostly halting

Washington

IF the withdrawal by Stanley Pons and Martin Fleischmann of the cold fusion paper submitted to *Nature* bolstered rising scepticism, enough happened this week to keep hopes alive. Claims of successful fusion arrived from California, India and Brazil, and Pons himself hinted at new experimental evidence. But at the press conferences at which the announcements were made, hard data have been lacking and conclusions unclear; still no verdict can be reached.

One positive note is the publication in this issue of the more modest claim by Steven Jones and his colleagues, at Brigham Young University, who give evidence for a small but significant increase in neutron flux when current is passed through a palladium cathode in a suitable electrolytic cell. Jones and his group believe that fusion is occurring, but at a level much below what Pons and Fleischmann need to explain their energy production rate.

That claim is now at the centre of the debate. Neither in the published paper nor in the version submitted to *Nature* is there enough detail for readers to make their own estimations of the workings of the electrolytic cells. That and some other relevant issues are dealt with elsewhere (see pages 701, 705, 710 and 711).

At a press conference in Salt Lake City on 17 April, Stanley Pons announced a qualitatively new piece of supporting evidence: mass spectroscopy of the gases evolving from a working fusion cell revealed the presence of ^{4}He in quantities consistent with the reported energy production, if all deuteron–deuteron fusions produce ^{4}He rather than tritium and a proton or ^{3}He and a neutron.

Cheves Walling, a colleague of Pons, says that gas from the cell was sampled and analysed, and a production rate of 10^{12} atoms per second was deduced after the total gas flow rate had been figured in. This rate of helium production is much greater than in the 1926 'cold fusion' experiments (page 692), in which about 10^{10} atoms were detected after several hours.

Walling and a colleague, John Simons, have submitted to the *Journal of Physical Chemistry* a theoretical paper suggesting how the high density of electrons in the palladium lattice could allow the high-energy photon expected, with a ^{4}He nucleus, to be converted into lattice vibrations and thus heat. Although Walling describes the theory as 'qualitative', he says that enhancements by many orders of magnitude of this normally rare fusion mode could be achieved.

At the 17 April press conference, Pons addressed an issue which has caused disquiet since it was brought up by Harold Furth, director of the Princeton University Plasma Physics Laboratory, at the recent meeting of the American Chemical society in Dallas, Texas (*Nature* **338**, 605; 1989) — the lack of a direct comparison between an electrolytic cell containing heavy water and one containing ordinary water. Pons tantalized his audience by indicating that preliminary results from just such a comparison suggested an "unexpected" production of heat in the ordinary cell. There are no numbers.

A similar comparison between 'light' and 'heavy' electrolytic cells was described at Stanford University on 18 April by Robert Huggins, of the Materials Science Department. He said that when two cells, identical except that one used H_2O and the other D_2O, were run side by side with the same voltage applied, the heavy-water cell consistently ran the hotter by as much as 15 per cent. Huggins says that differences in the specific heat of heavy and light water, or in the diffusion rates of hydrogen and deuterium into the palladium electrode, are not large enough to explain the results.

Other groups are attempting similar comparisons, but none has yet reported success; Huggins says that there are "a couple of features" in his set-up that others may have missed, but these will not be revealed until a special session of the meeting of the Materials Research Society, scheduled for the evening of 26 April in San Diego.

In India, two groups claim to have achieved cold fusion in electrolytic cells similar to those used at the University of Utah. A third group, at the Bhabha Atomic Research Centre (BARC) in Bombay, is setting up a large-scale electrolysis reactor expected to produce results towards the end of May.

C.K. Mathews and colleagues at the Indira Gandhi Atomic Research Centre (IGARC) at Kalpakkam near Madras have reported neutron production from electrolysis of heavy water using a platinum anode and a titanium cathode. The team used an electrolyte of nickel and palladium chlorides at 0.2 per cent concentration rather than the lithium salt used by Pons and Fleischmann. "We observed a 30 per cent increase in neutron flux over the background level, suggesting that fusion was taking place", said IGCAR director Dr C.V. Sundaram. No measurements were made of energy output. Sundaram said the results were not always reproducible because the experimental parameters had not been optimized.

In an almost identical set-up at the Tata Institute of Fundamental Research in Bombay, researchers claimed to have observed energy amplification, but they did not look for neutrons. Professor K.S.V. Santhanam and his colleagues in the chemical physics group said that passage of 0.25 watts of electrical power through the cell produced one watt of thermal output at the titanium cathode, whose temperature rose to 80° C in a sustained reaction. Heavy water mixed with sodium chloride was used as the electrolyte and platinum as anode in this experiment.

BARC's director, Dr P.K. Iyengar, said his group is setting up a much larger version of the Utah experiment with sophisticated instrumentation for measuring heat as well as fusion products. Results are expected in a month. But Iyengar, a well-known reactor physicist, is sceptical.

India is one of the few countries producing heavy water in commercial quantities and may therefore have an advantage if cold fusion is real. BARC is also interested in cold fusion as an inexpensive neutron source, which could be used, instead of fast-breeder reactors, to transmute India's 360,000-tonne reserve of thorium into uranium-233 fuel. But BARC's spirit has been dampened by reports that, whatever happens inside palladium, it does not produce a large neutron flux.

In Brazil, two groups have announced, by the now-traditional press conference, that they have obtained fusion reactions while trying to replicate the Utah experiments. The first team to report, from the Physics Institute of the University of São Paulo, said on 19 April that it had detected neutrons at twice the background level. Spero Penha Morato says that only a deuteron–deuteron reaction could account for this excess of neutrons, but the team was not equipped to measure heat production.

The second announcement, on 29 April, from the Institute of Space Research (INPE) in São Jose dos Campos in São Paulo state, says that a group headed by Gerson Otto Ludwig and known for work on fusion by magnetic confinement has reported two separate neutron bursts during a 100-hour experimental run. The first burst, after ten hours, had an intensity of ten times background; the second, after 35 hours, four times. At another press conference on 21 April, the same group announced it had detected ^{3}He, thus proving that fusion reactions had occurred. □

Observation of cold nuclear fusion in condensed matter

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When a current is passed through palladium or titanium electrodes immersed in an electrolyte of deuterated water and various metal salts, a small but significant flux of neutrons is detected. Fusion of deuterons within the metal lattice may be the explanation.

FUSION of the nuclei of isotopes of hydrogen is the principal means of energy production in the high-temperature interiors of stars. In relatively cold terrestrial conditions, the nuclei are surrounded by electrons and can approach one another no more closely than is allowed by the molecular Coulomb barrier. The rate of nuclear fusion in molecular hydrogen is then governed by quantum-mechanical tunnelling through that barrier, or equivalently, the probability of finding the two nuclei at zero separation. In a deuterium molecule, where the equilibrium separation between deuterons (d) is 0.74 Å, the d-d fusion rate is exceedingly slow, about 10^{-74} per D_2 molecule per second[1].

By replacing the electron in a hydrogen molecular ion with a more massive charged particle, the fusion rate is greatly increased. In muon-catalysed fusion, the internuclear separation is reduced by a factor of ~200 (the ratio of the muon to electron mass), and the nuclear fusion rate correspondingly increases by about eighty orders of magnitude. Muon-catalysed fusion has been shown to be an effective means of rapidly inducing fusion reactions in low-temperature mixtures of hydrogen isotopes[2,3].

A hypothetical quasi-particle a few times as massive as the electron would increase the cold fusion rate to readily measurable levels of $\sim 10^{-20}$ fusions per d-d molecule per second[1]. The results reported here imply that a comparable distortion of the internuclear wavefunction can be realized when hydrogen isotope nuclei are loaded into metals under certain conditions. We have discovered a means of inducing nuclear fusion without the use of either high temperatures or radioactive muons.

Indirect evidence

Observations of naturally occurring ^{3}He in the Earth suggested to us new directions for laboratory investigations of nuclear fusion in condensed matter. ^{3}He is produced by the following fusion reactions:

$$p + d \rightarrow {}^3He + \gamma(5.4\ MeV) \quad (1)$$

$$d + d \rightarrow {}^3He(0.82\ MeV) + n(2.45\ MeV) \quad (2a)$$

$$\rightarrow t(1.01\ MeV) + p(3.02\ MeV) \quad (2b)$$

Tritium (t) decays with a 12.4-yr half-life to produce ^{3}He. The well established high ^{3}He/^{4}He ratio in solids, liquids and gases associated with volcanoes and other areas of high heat flow[4-6] suggests fusion as a possible source for the ^{3}He.

To estimate a possible rate of fusion in the Earth, we assume a simple, steady-state model in which the known flux of ^{3}He out of the mantle, 2×10^{19} ^{3}He atoms per second[7], arises from p-d fusion occurring uniformly in the mantle water reservoir, taken as $\sim 1.4 \times 10^{24}$ g (R. Poreda, personal communication). Note that if the Earth contains 'primordial' ^{3}He, our calculated rate will be an upper limit; on the other hand, if fusion-produced ^{3}He is stored in the mantle (so that the outward flux does not equal the production rate), our value will be a lower limit. As each p-d fusion produces one ^{3}He atom, and as the isotopic abundance of deuterium in water is $\sim 1.5 \times 10^{-4}$ deuterons per proton, we infer a geological fusion rate constant, λ_f, of

$$\lambda_f \approx \frac{2 \times 10^{19}\ {}^3He\ atoms\ s^{-1}}{1.4 \times 10^{43}\ deuterons}$$

$$\approx 10^{-24}\ fusions\ d^{-1}\ s^{-1} \quad (3)$$

This rate is fifty orders of magnitude larger than that expected in an isolated HD molecule, and fusion at this rate could be detected if reproduced in the laboratory.

Cold nuclear fusion may be important in celestial bodies other than the Earth. Jupiter, for example, radiates about twice as much heat as it receives from the Sun. It is interesting to consider whether cold nuclear fusion in the core of Jupiter, which is probably metallic hydrogen plus iron silicate, could account for its excess heat. Heat is radiated at an approximate rate of 10^{18} watts, which could be produced by p-d fusions occurring at a rate of 10^{30} s^{-1}[1]. Assuming a core of radius 4.6×10^9 cm, containing mostly hydrogen, with density ~10 g cm^{-3} and a deuteron/proton ratio of $\sim 10^{-4}$, we deduce a required p-d fusion rate of $\lambda_f \approx 10^{-19}$ fusions d^{-1} s^{-1} if all the heat derives from fusion. Catalysed nuclear fusion at this rate could be readily measured in the laboratory.

Further evidence for cold nuclear fusion in condensed matter comes from studies of ^{3}He and ^{4}He in metals. There have been several reports of high ^{3}He concentrations in metal crucibles and foils (H. Craig, R. Poreda, A. Nier, personal communications), consistent with *in situ* formation by cold fusion. In particular, Mamyrin *et al.*[8] report the occurrence of patchy, high concentrations of ^{3}He in a number of metal foils. Electrolytic refining of the metals could have provided the appropriate conditions for the cold nuclear fusion reactions (1) and possibly (2). Among several possible explanations for the observations, the authors suggest an analogue of muon catalysis[8].

Detection of cold-fusion neutrons

The considerations outlined above led to laboratory experiments performed at Brigham Young University to determine whether cold nuclear fusion can actually occur in condensed matter. We now report the observation of deuteron-deuteron fusion at room temperature during low-voltage electrolytic infusion of deuterons into metallic titanium or palladium electrodes. The fusion reaction (2*a*) is apparently catalysed by the deposition of d^+ and metal ions from the electrolyte at (and into) the negative electrode. Neutrons with an energy of ~2.5 MeV are clearly detected with a sensitive neutron spectrometer. The experimental layout is shown in Fig. 1.

The neutron spectrometer, developed at Brigham Young University over the past few years (ref. 9 and manuscript in preparation) has been crucial to the identification of this cold fusion process. The detector consists of a liquid organic scintillator (BC-505) contained in a glass cylinder 12.5 cm in diameter, in

which three glass scintillator plates doped with lithium-6 are embedded. Neutrons deposit energy in the liquid scintillator through multiple collisions, and the resulting light output yields energy information. As their energy decreases, the neutrons are scavenged by ^{6}Li nuclei, and the reaction $n + {}^6Li \rightarrow t + {}^4He$ results in scintillations in the glass. Pulse shapes and amplitudes from the two scintillators differ; the two distinct signals are registered by two photomultiplier tubes, whose signals are summed. A coincidence of identified signals from the two media within 20 μs identifies an incoming neutron that has stopped in the detector.

The spectrometer was calibrated using 2.9- and 5.2-MeV neutrons generated by deuteron–deuteron interactions at 90° and 0°, respectively, with respect to a deuteron beam from a Van de Graaff accelerator. The observed energy spectra show broad structures which imply that 2.45-MeV neutrons should appear in the multichannel analyser spectrum in channels 45–150. The stability of the detector system was checked between data runs by measuring the counting rate for fission neutrons from a broad-spectrum californium-252 source.

We have performed extensive tests to verify that the neutron spectrometer does not respond preferentially in this pulse height range to other sources of radiation such as thermal neutrons. In particular, we made unsuccessful efforts to generate false 2.5-MeV neutron 'signals' by using various γ-ray and neutron sources and by turning auxiliary equipment on and off. Neutron-producing machines such as the Van de Graaff accelerators were off during all foreground and background runs.

Many background runs were made using operating cells (described below) containing standard electrodes and electrolytes, except that H_2O replaced the D_2O; other background runs were made using both new and previously used standard cells containing D_2O plus the usual electrolyte but with no electrical current. The individual background runs were all featureless and closely followed the pattern of the integrated background shown in Fig. 2. Background rates in the neutron counter are $\sim 10^{-3}$ s^{-1} in the energy region where 2.5-MeV neutrons are anticipated. By comparing energy spectra from γ-ray and neutron sources we have determined that approximately one-fourth of the observed background events arise from accidental coincidences of γ-rays and three-fourths from ambient neutrons. The γ-ray background comes mainly from radioactive radium and potassium in the surrounding materials. We attribute the ambient neutrons to cosmic-ray sources. Although the typical neutron evaporation spectrum (at birth) has a broad maximum near 2.5 MeV (ref. 10), Monte Carlo calculations show that moderation in the source medium (predominantly the shielding surrounding the detector) will wash out this structure and produce a smoothly decreasing background spectrum above 0.5 MeV, as observed.

The predicted and measured absence of structure in the spectrum of cosmic-ray-produced neutrons will not be influenced by the relatively small temporal variations that may occur in the cosmic-ray flux, such as the observed decreases that may accompany solar flares. This means that the observed peak at 2.5 MeV cannot be accounted for by ambient-neutron background variations, because, as explained below, the analysis is based on the shape of the spectra and not simply on rates. Low-energy cosmic-ray muons would be rapidly scavenged by nuclei with high atomic number, so as to reduce muon-catalysed d–d fusion to a negligible level[2,3]. Considering volume and solid angle, the rate of production of neutrons by muons absorbed by carbon nuclei in the detector exceeds that from muons absorbed by oxygen nuclei in the electrolytic cells by a factor of ~60. Thus, the presence or absence of electrolytic cells is an unimportant perturbation in the background.

During the search for suitable catalytic materials, the following (unoptimized) prescription for the electrolytic cells evolved. It began with salts typical of volcanic hot springs and included electrode-metal ions. The electrolyte is typically a mixture of ~160 g D_2O plus various metal salts in ~0.1 g amounts each: $FeSO_4 \cdot 7H_2O$, $NiCl_2 \cdot 6H_2O$, $PdCl_2$, $CaCO_3$, $Li_2SO_4 \cdot H_2O$, $Na_2SO_4 \cdot 10H_2O$, $CaH_4(PO_4)_2 \cdot H_2O$, $TiOSO_4 \cdot H_2SO_4 \cdot 8H_2O$, and a very small amount of AuCN. The pH is adjusted to ≤3 with HNO_3. All 14 runs reported here began with this basic electrolyte.

Titanium and palladium, initially selected because of their large capacities for holding hydrogen and forming hydrides, were found to be effective negative electrodes. Individual electrodes consisted of ~1 g purified 'fused' titanium in pellet form, or 0.05 g of 0.025-mm-thick palladium foils, or 5 g of mossy palladium. Typically 4–8 cells were used simultaneously. The palladium pieces were sometimes re-used after cleaning and roughening the surfaces with dilute acid or abrasives. Hydrogen bubbles were observed to form on the Pd foils only after several minutes of electrolysis, suggesting the rapid absorption of

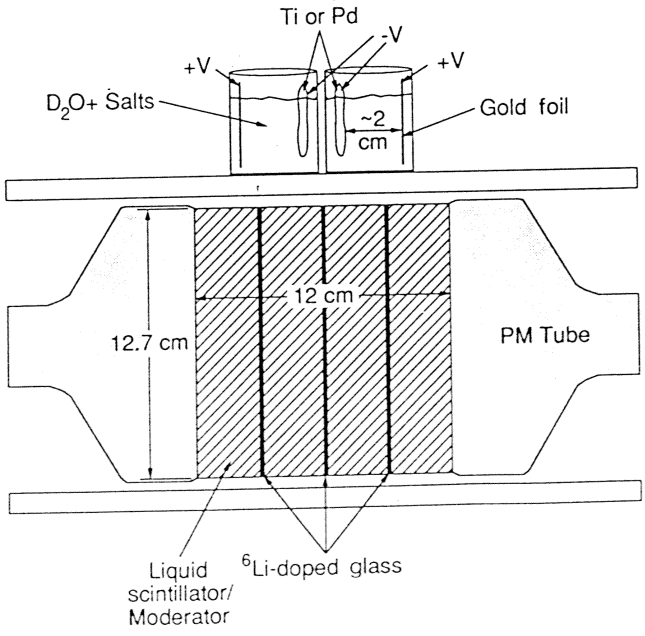


FIG. 1 Schematic diagram of the experiment. Electrolytic cells are shown on top of the neutron spectrometer.

deuterons into the foil; oxygen bubbles formed at the anode immediately. Gold foil was used for the positive electrodes. Direct-current power supplies provided 3–25 volts across each cell at currents of 10–500 mA. Correlations between fusion yield and voltage, current density, or surface characteristics of the metallic cathode have not yet been established.

Small jars, ~4 cm high and 4 cm in diameter, held ~20 ml of electrolyte solution each. The electrolytic cells were placed on or alongside the neutron counter, as shown in Fig. 1. The present cells are simple and undoubtedly far from optimum. Nevertheless, the present combination of our cells with the neutron spectrometer is sufficient to establish the phenomenon of cold nuclear fusion during electrolytic infusion of deuterium into metals.

Figure 2 shows the energy spectrum obtained under the conditions described above, juxtaposed with the (scaled) background spectrum. We acquired about twice as much background data as foreground data. Assuming conservatively that all deviations from background are statistical fluctuations, we scale the background counts by a factor of 0.46 to match the total number of foreground counts over the entire energy range shown in Fig. 2. A feature in channels 45–150 rises above background by nearly four standard deviations. This implies that our assumption is too conservative and that this structure represents a real physical effect. After re-scaling the background by a factor of 0.44 to match the foreground levels in regions just below and just above this feature, the difference plot (Fig. 3) is obtained. It shows a robust signal centred near channel 100, with a statistical significance of almost five standard deviations. A gaussian fit to this peak yields a centroid at channel 101 with a standard deviation of 28 channels, and an amplitude of 23.2 ± 4.5 counts. Both the position and width of this feature correspond to those expected for 2.5-MeV neutrons, according to the spectrometer calibration. The fact that a significant signal appears above background with the correct energy for d–d fusion neutrons (~2.5 MeV) provides strong evidence that room-temperature nuclear fusion is occurring at a low rate in the electrolytic catalysis cells.

Fusion rate determination

It is instructive to examine the fourteen individual runs which enter into the combined data discussed above. These runs were performed over the period 31 December 1988 to 6 March 1989. Figure 4 displays, for each run, the ratio of foreground count rate in the 2.5-MeV energy region to the background rate

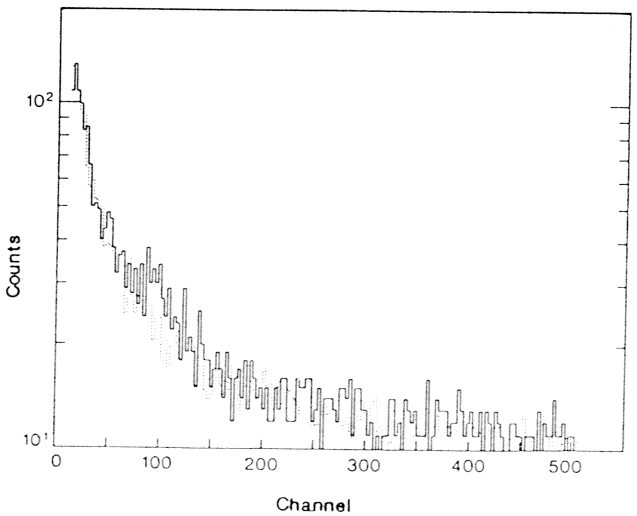


FIG. 2 Foreground (solid) and background (dashed) counts as a function of pulse height (corresponding to neutron energy) in the neutron spectrometer. Ten counts have been added to each three-channel bin for clarity of presentation.

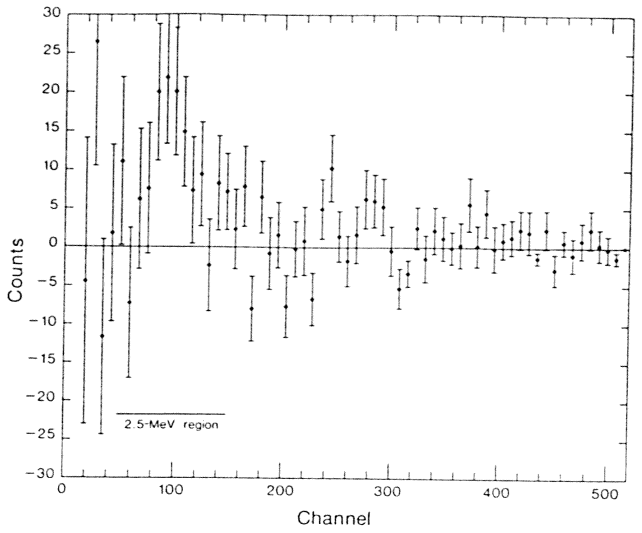


FIG. 3 Difference spectrum obtained by substracting scaled background from the foreground. Statistical errors (±1σ) are shown for each eight-channel bin.

obtained for each run. Electronic changes were made in the apparatus during the course of the experiment which altered the observed background rates, so we plot the data in terms of foreground-to-background ratios rather than absolute rates. In one set of data (runs 1 to 8) for which the system was kept as untouched as possible to avoid changes in background rates, the measured rate of detection of 2.5-MeV neutrons was (6.2 ± 1.3) × 10^{-4} s^{-1} above background. For this set of data, the background and foreground rates for all energies above ~3 MeV (that is, for all channels from 190 to 512) are equal, at (1.4 ± 0.1) × 10^{-3} s^{-1}.

Run 6 is particularly noteworthy, with a statistical significance of approximately five standard deviations above background. Fused titanium pellets were used as the negative electrode, with a total mass of ~3 g. The neutron production rate increased after about one hour of electrolysis. After about eight hours, the rate dropped dramatically, as shown in the follow-on run 7. At this time, the surfaces of the titanium electrodes showed a dark grey coating. An analysis using electron microscopy with a microprobe showed that the surface coating was mostly iron, deposited with deuterons at the cathode. The same phenomenon of a decrease in the neutron signal after about eight hours of operation appears in run 13 followed by run 14. Runs 13 and 14 use the same eight electrochemical cells, and again the negative electrodes developed coatings after a few hours of electrolysis. These observations suggest the importance of surface conditions for the cold fusion process. Variations in surface conditions and electrolyte composition are anticipated during each test run because materials plate out of solution; the solution pH also changes significantly during a run. These 14 runs represent two choices of electrode material plus various operating currents. These variations may account for the fluctuations in the signal level that are evident in Fig. 4. As these runs represent a total of only ~200 signal neutrons at an average rate of ~2 per hour, it was difficult to optimize experimental conditions. This is a task for future research.

The observed 'turning off' of the signal after about eight hours may account for low signal-to-background ratios in runs 1 and 3, in that a signal that lasted for only a few hours may have been overwhelmed after a long (~20-hour) running time. When run 10 started with rates substantially above background, we stopped the run and removed half of the electrochemical cells as a test. The neutron production rate dropped off as expected (run 11). In determining the statistical significance of the data, we included runs 1, 3, 7, 11 and 14, even though we see a

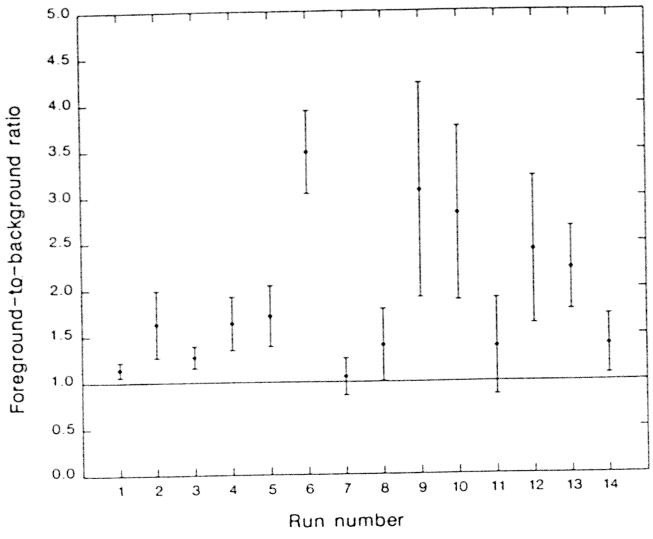


FIG. 4 Ratio of foreground rate to background rate for each run, in the 2.5-MeV energy region of the pulse-height spectrum. Statistical errors ($\pm 1\sigma$) are shown.

systematic reason for their low foreground-to-background ratios as explained above. Run 8, shown in Fig. 4, was inadvertently lost from the magnetic storage device and could not be included in Figs 2 and 3. This does not change our conclusions.

We can estimate the rate for the neutron-production branch of d-d fusion during electrolysis, specifically for run 6, as follows:

$$\text{Fusions per deuteron pair per second} = \frac{R/\varepsilon}{M \times \frac{d}{2M}} \quad (4)$$

where the observed rate of neutron detection, $R = (4.1 \pm 0.8) \times 10^{-3}\ s^{-1}$, is based on foreground minus corresponding background counts in channels 45–150; the neutron detection efficiency, including geometrical acceptance, is calculated using a Monte Carlo neutron-photon transport code[11] to be $\varepsilon = (1.0 \pm 0.3)\%$; $M \approx 4 \times 10^{22}$ titanium atoms for 3 g of titanium; and the ratio of deuteron pairs to metal ions, $d/2M \approx 1$, is based on the assumption that nearly all tetrahedral sites in the titanium lattice are occupied, forming the γ-TiD_2 hydride. Then the estimated cold nuclear fusion rate for the neutron-production branch, by equation (4), is $\lambda_f \approx 10^{-23}$ fusions per deuteron pair per second. If most fusions take place near the surface, or if the titanium lattice is far from saturated with deuterons, or if conditions favouring fusion occur intermittently, then the inferred fusion rate must be much larger, perhaps 10^{-20} fusions per deuteron pair per second.

We note that such a fusion rate could be achieved by 'squeezing' the deuterons to about half their normal (0.74-Å) separation in molecules. That such rates are now observed in condensed matter suggests catalysed 'piezonuclear' fusion as the explanation[1]. A possible cause is that quasi-electrons form in the deuterated metal lattice, with an effective mass a few times that of a free electron. Isotopes of hydrogen are known to accumulate at imperfections in metal lattices[12], and a local high concentration of hydrogen ions might be conducive to piezonuclear fusion. Because we have not seen any evidence for fusion in equilibrated, deuterated metals or compounds such as methylamine-d_2 deuteriochloride or ammonium-d_4 chloride, we conclude that non-equilibrium conditions are essential. Electrolysis is one way to produce conditions that are far from equilibrium.

It may seem remarkable that one might influence the effective rate of fusion by varying external parameters such as pressure, temperature and electromagnetic fields, but just such effects are seen in another form of cold nuclear fusion, muon-catalysed fusion[13].

Conclusions

The correlation of ideas regarding cold piezonuclear fusion[1] with observations of excess ^{3}He in metals and in geothermal areas of the Earth led to our experimental studies of fusion in electrochemical cells, which began in May 1986. Our electrolyte compositions evolved from geochemical considerations, and changed as results were observed. The presence of a fusion neutron signal was consistently reproduced, although the rate varied widely. Now that our exploratory searches have disclosed a small piezonuclear fusion effect, it remains to disentangle the factors that influence the fusion rate.

The need for off-equilibrium conditions is clearly implied by our data, and suggests that techniques other than electrochemistry may also be successful. We have begun to explore the use of ion implantation and of elevated pressures and temperatures, mimicking geological conditions. Cold nuclear fusion in condensed matter may be of interest as a novel probe of metal-hydrogen systems, including geological ones, and as a source of monoenergetic neutrons. If deuteron-deuteron fusion can be catalysed, then the d-t fusion reaction is possibly favoured because of its much larger nuclear cross-section. Although the fusion rates observed so far are small, the discovery of cold nuclear fusion in condensed matter opens the possibility, at least, of a new path to fusion energy. □

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■ For a comment from one of the referees of this paper, please see page 711.

COLD FUSION

More than scepticism

Baltimore

As researchers from laboratories and universities throughout the United States lined up to announce their failure to achieve cold fusion, a late-night session of the American Physical Society (APS), in Baltimore last Monday, took on the atmosphere of a hanging party lacking only its intended victims — Stanley Pons and Martin Fleischmann.

Loud applause greeted the remark by Steven Koonin, of the University of California at Santa Barbara, that the heat supposedly generated in a palladium electrode was a sign of "incompetence, perhaps delusion" on the part of the University of Utah researchers.

More significant than the list of negative results were the explanations offered by some of the speakers for the disputed claims. The 2.2 MeV gamma-rays offered by Pons and Fleischmann as evidence for the production of fast neutrons could, some speakers suggested, be due to radioactive decays of bismuth derived from naturally occurring radon, and the presence of helium-4 in a few parts per million could result from contamination by laboratory air rather than fusion of deuterium.

But the centrepiece of Pons and Fleischmann's claim, that heat is produced in their electrolytic cells in amounts too large to be explained by purely chemical processes, was dissected by Nathan Lewis, of the California Institute of Technology, and W. Meyerhof, of Stanford University, who ascribed the energy generation to poor calorimetry and an inadequate accounting of the data.

By contrast, Steven Jones, of Brigham Young University, met with a polite but generally sceptical reception. His claim of nuclear fusion, signified by neutron emission at a very low rate, survived the evening mostly unscathed, because most of the experimenters reporting their results did not have neutron detectors of the same sensitivity. But J. Dickens, of Oak Ridge National Laboratory in Tennessee, put in a vote against Jones, saying that his own group had failed to find neutrons at a level nearly ten times below what the Brigham Young group has argued for.

A certain amount of enmity had been generated the previous week, when Pons and Fleischmann told the House Committee on Science, Space and Technology on 26 April that they were "sure as sure can be" that cold fusion worked. Chase Peterson, president of the University of Utah, suggested $25 million as a reasonable amount of money for the federal government to spend on a scaling-up of bench-top fusion experiments.

At the same hearing, Jones made it clear that, although he believed in the reality of cold fusion, he saw it as an interesting piece of physics, not as a technology for energy production. By the time physicists such as Harold Furth, director of the Princeton University Plasma Physics Laboratory, were giving their sceptical testimony, most of the congressmen had left. The hearing nevertheless provided an opportunity for some committee members to praise the virtues of "small science", and applaud the invention of an American technology that will "change the face of the Earth".

But questions about the lack of confirmation by other scientists and the continued absence of a full published account of the work made several congressmen nervous of jumping in too soon with federal funds. To dispel such doubts, Ira Magaziner, a consultant to the University of Utah, listed half a dozen previous US inventions which had been brought to commercial fruition by the Japanese, and urged the committee to move now, even before the science was widely accepted.

Yet it is unlikely that any congressional initiatives will emerge while the scientific status of cold fusion changes daily. Robert Huggins, a materials scientist at Stanford University, was warmly received by the committee for his account of an experiment which seemed to confirm heat generation by cold fusion, but later flew to San Diego and into a more questioning audience when he described his results in full at a hastily organized session of a meeting of the Materials Science Research Society.

Huggins and his colleagues say they have observed temperature differences of up to 10°C between a cell containing deuterated water and an identical cell containing ordinary water, representing an excess energy in the deuterated sample of 15 to 40 per cent.

The secret of his success, Huggins said, lies in the elimination of hydrogen from the palladium electrode and the cell containing heavy water, by repeated melting and recasting of the electrode material and assembly of the apparatus in a glove-box filled with dry nitrogen. Regular hydrogen will readily pollute the experiment, he said, if introduced either as hydrogen occupying sites in the palladium matrix or as water from the atmosphere, which will be absorbed by the heavy water and preferentially hydrolysed at the palladium cathode.

This experiment, as well as the work of Pons and Fleischmann, was criticized at a fundamental level by speakers at the Baltimore meeting last Monday. Both Lewis and Meyerhof spoke of the difficulty of doing exact calorimetry in an open system which gives off gases and needs to be replenished with fresh electrolyte. The rate of energy generation is derived from a measurement of the temperature of a working cell, and it is in this measurement that experimental niceties can prove overwhelming.

Neither Huggins nor Pons and Fleischmann attempted to stir the electrolyte in their cells, which suggests that temperature gradients can develop, and means that different temperatures can be due either to different energy generation rates or more simply to different placements of the thermometer in the cell.

Both Lewis and Meyerhof had attempted to reproduce the exact cell construction used by Pons and Fleischmann. They did this by examining whatever photographs and diagrams they could find, and deriving a scale from the size of Pons's hand. Both Lewis, by demonstration, and Meyerhof, by calculation, then showed that 'energy generation' of the magnitude claimed could arise because the temperature distribution in the cell was far from uniform, and the thermometer placement gave rise to a misleading heat output.

The problem was aggravated, Lewis said, because the table of results given by Pons and Fleischmann listed energy outputs not as a percentage of the total energy supplied, but as a percentage of the calculated and strictly chemical heat output. The energy discrepancies, as found by Lewis by back-calculation from the published data, are not so startling in magnitude.

In the experiments done by Lewis and his colleagues, the electrolytic cell was stirred to maintain a uniform temperature, and was also kept at a constant temperature by means of a resistive heater: if the electrode voltage was reduced, the heater was turned up by a measured amount to keep the total heat supply the same. Thus the calorimeter had constant internal calibration. In a still-continuing series of experiments and comparisons, Lewis reported that they had found no anomalous heat generation to a level of 6 per cent, the emprically estimated accuracy of their device.

At the end of the session at Baltimore, physicists were left with the comfortable feeling that fusion was dead, except for small effects of the sort claimed by the Brigham Young group. If, and how quickly, chemists come to the same conclusion is not yet apparent.

David Lindley

Corrections

THE statement in our article on 27 April (**338**, 702; 1989) that the Brigham Young group had not replicated their measurement with H_2O is incorrect. Such a replication is described in their original article (**338**, 737; 1989). A News story in the 20 April issue of *Nature* (**338**, 605; 1989) incorrectly refers to a press conference at Texas A & M on 10 March: this should be 10 April. And reports of an experiment at the University of Moscow were received on 12 April, not 12 March. Keith Johnson of MIT was incorrectly referred to as Keith Jones. □

COLD FUSION

Still no certainty

Los Angeles

ANY expectation that a verdict on the reality of cold fusion would soon be delivered remained unfulfilled after the special session of the Electrochemical Society's meeting in Los Angeles last Monday. Martin Fleischmann and Stanley Pons retreated on some of their claims but firmly defended their measurement of the heat output of their electrolytic cells against recent charges of sloppy experimental technique. By the end of the evening, the University of Utah researchers and their critics were still at a standoff on most of the disputatious issues, but the audience was clearly unhappy at Pons and Fleischmann's reluctance to take up offers of help from other scientists to analyse parts of the experiment more closely.

In contrast to the previous week's meeting of the American Physical Society in Baltimore (see *Nature* **339**, 4; 4 May 1989), where Pons and Fleischmann were convicted *in absentia*, the Los Angeles meeting was both more sympathetic and more hopeful. Nevertheless some naysayers, notably Nathan Lewis of the California Institute for Technology, were able to get on to the programme.

Responding to assertions by Lewis in Baltimore that their temperature measurement was flawed, Pons and Fleischmann showed a video recording of one of their cells in action, in which obvious and vigorous bubbling was adduced as the means by which a uniform temperature was maintained throughout the cell. Furthermore, a dye (phenolphthalein) introduced into the electrolyte was visibly well-mixed in about 20 seconds. But Lewis said later on that the calibration of the cell's energy output was still of unquantified accuracy. In Pons and Fleischmann's set-up, a relation between heat flow and temperature differential is obtained by the use of a resistive heater, through which a measured energy is passed before electrolysis is begun; what remains undemonstrated, according to Lewis, is that the calibration, performed when the electrolyte is still, is a useful measure of what happens when the cell is working and the electrolyte is seething with evolved gases.

But on the question of whether fusion by-products had been seen there was a retreat. Fleischmann said that criticisms of their gamma-ray line at 2.2 MeV, that it was too narrow and too weak to be the neutron-capture line they claimed, were ones that he too had worried about and expressed to Pons before publication, and that they were working on new measurements. And claims that a significant production of helium-4 had been detected (see *Nature* **338**, 691; 27 April 1989) were premature.

Support for cold fusion came from Robert Huggins of Stanford University, who repeated his claim that a heavy-water electrolytic cell ran consistently hotter than an identical light-water one, and from a number of speakers from Texas A&M University, who showed calorimetric data indicating that a palladium cathode in a heavy-water electrolyte produced excess heat, while platinum in heavy water and palladium in light water produced nothing out of the ordinary. Fleischmann declared that any suggestions that control experiments done with ordinary water were yielding excess heat comparable to that produced with heavy water were "total nonsense".

But Steven Jones of Brigham Young University emphasized the need to have detections of some fusion products; anomalous heat alone does not prove that nuclear processes are at work. It was mentioned repeatedly that helium is retained by palladium for up to 12 years, and that if heat was being generated at the rate claimed by Pons and Fleischmann, a post-mortem of an electrode would reveal high helium concentrations. Members of the audience offered to analyse a piece of one of the Utah electrodes, but Pons declined, saying that arrangements had already been made, with a laboratory he would not identify, to do similar analyses.

At the end of the session, no useful resolution had been reached. Those who argued that cold fusion works also admitted that reproducibility was difficult. Robert Huggins claimed that the palladium had to be cast, not annealed, and that it had to be purged of hydrogen; U. Landau of Case Western Reserve University described some preliminary suggestions of excess heat from annealed electrodes. J. Bockris of Texas A&M University said that out of twenty palladium electrodes tested by three different collaborations at the University, only 5 or 6 produced heat. To explain these mystifying variations, Bockris argued that fusion occurs when large concentrations of deuterium build up around defects and dislocations in the palladium (see this week's issue, *Nature* **339**, 105; 1989), but this made no impression on Nathan Lewis who said that the group at the California Institute of Technology had tried 50 electrodes, some cast, some annealed, and none of them worked.

No true discussion between boosters and critics occurred. At a later press conference, Fleischmann said it was difficult for him to respond to Lewis's criticisms because he had not seen all the data in a published paper, with all details made available. According to Pons, they hoped to publish a full paper describing the calorimetry behind his and Fleischmann's results later in the summer. **David Lindley**

GLOBAL WARMING

Row in the Senate over altered testimony

Washington

AN ATTEMPT by US President George Bush's Office of Management and Budget (OMB) to modify congressional testimony on global warming caused outrage earlier this week at a Senate subcommittee hearing on "Possible climate surprises predicting greenhouse warming". James Hansen, head of the US National Aeronautics and Space Administration (NASA)'s Goddard Institute for Space Studies said that OMB altered his written testimony and made him appear to negate his own predictions of global climate changes by saying they were only "estimates" and not "reliable predictions".

The hearing came as administration officials attending the United Nations Intergovernmental Panel on Climate Change in Geneva were briefed to go slow and recommend more studies during discussions of international agreements to protect the atmosphere. The Bush administration reacted coldly to a Senate resolution calling on the United States to take the lead in setting up an international convention to slow global warming.

Senator Albert Gore, Jr (Democrat, Tennessee), who chaired the hearing, said the changes in Hansen's testimony had been made by "a nameless, faceless bureaucrat" from a "kind of science Politburo". Preventing the best scientists from giving their best data to Congress "is a form of science fraud" and an "outrage of the first order of magnitude", said Gore. Committee member Senator Richard Bryan (Democrat, Nevada) added that Bush seemed to be fulfilling his campaign promise to "counter the greenhouse effect with the White House effect" by using the "whitewash effect" instead.

Hansen said that more than a year ago he chose to appear before Congress as a private citizen rather than accept changes to his testimony made by OMB. All formal testimony by government employees — including government scientists — must first be vetted by the administration.

At a press briefing, White House spokesman Marlin Fitzwater defended the Administration's action by saying "OMB's position was that it was a policy issue and not a scientific one". He conceded that the changes were made by an OMB employee at least "four levels down from the top", and that Hansen was in his rights to present his own conclusions during oral questioning, even if they differed from his approved testimony. When asked if he was worried about retributions for his candour, Hansen replied "I am now". Carol Ezzell

Explanations of cold fusion

SIR—I suggest that electrolysis of a heavy-water solution of deuterated lithium hydroxide with a palladium cathode leads to the formation of a higher deuteride of palladium, probably PdD_2 with the fluorite structure, the subsequent decomposition of which leads to the increased evolution of heat or to the explosion of the deuteride into palladium powder and hydrogen gas.

In a paper in *Physical Review* in 1938 I pointed out that in the transition metals 0.72 orbital per atom of the orbitals in the outer shell remains apparently unused. Later, I identified the 0.72 orbital per atom as the metallic orbital, required for the unsynchronized resonance of covalent bonds that confers metallic properties on a substance. The principal evidence for the metallic orbital is that the curve of the saturation paramagnetic moments of the iron-group metals has a foot at the composition $Ni_{44}Cu_{56}$. I also pointed out that the need for the metallic orbital for stability explains the fact that palladium is saturated with hydrogen at the composition $PdH_{0.6}$. Introduction of additional hydrogen atoms leads to instability because of the loss of resonance energy when the metallic orbital is not available.

I judge that under the conditions of the electrolysis experiments of M. Fleischmann and S. Pons (*J. electroanalyt. Chem.* **261**, 301–308; 1989) deuterons beyond this limit are forced into the palladium cathode, ultimately forming the unstable higher deuteride. Later, after the beginning of electrolysis, this unstable deuteride may begin to decompose either slowly, resulting in an increased liberation of heat, or explosively, as Fleischmann and Pons observed when a 1-cm cube of the deuterated palladium disappeared.

It can be predicted that, because of the difference in amplitude of the zero-point vibrations of the nuclei with different masses, palladium dihydride would be less stable than palladium dideuteride, and palladium ditritide would be more stable — perhaps stable enough to permit examination by X-ray diffraction.

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SIR—Hydrogen in metals may tend to segregate to cracks, grain boundaries or interfaces and to dislocations. This is a well-known phenomenon and it explains several important observations such as hydrogen-induced fracture in ferritic steels. We suggest that prior accumulation of hydrogen in defects in palladium electrodes may prevent the build-up of deuterium, and that this could explain why cold fusion is hard to replicate.

The equilibrium segregation of hydrogen can be characterized as a function of the binding energy and of the local stress for the special case of a crack. The quantity of segregated hydrogen, $(C_H)_j$ is given by

$$(C_H)_j = \frac{C_m \exp((\Delta H_B)_{cf}/kT)}{1 - C_m + C_m \exp((\Delta H_B)_{cf}/kT)}$$

For a surface, grain boundary, interface or dislocation, the effective binding energy of hydrogen is $(\Delta H_B)_{cf} = (\Delta H_B)_j$, whereas for a crack-tip it is $(\Delta H_B)_{cf} = (\Delta H_B)_j + \sigma_l V_H$. In these equations, the binding energy is ΔH_B and the local stress is σ_l. The subscript j indicates the segregation site of the hydrogen (for example, s for crack surfaces and b for boundaries). C_m is the bulk hydrogen content, V_H is the molar volume of hydrogen, k is Boltzmann's constant and T the absolute temperature. $(\Delta H_B)_j$ can be described by the standard chemical potentials of hydrogen and the metallic matrix in which it segregates, at the segregation site and remote from it. Thus the magnitude of $(\Delta H_B)_j$ depends on the type of hydrogen segregation site[1].

We suggest that when in a cold fusion experiment a palladium electrode is immersed in a heavy water-based electrolyte, the deuterium diffuses into the palladium and segregates to dislocations and other defects according to the above equation. When the concentration in these local regions has reached a high enough level, the reaction commences in the segregated region. We are unable to say just what the reaction is, but it may be a form of nuclear fusion or some chemical reaction. The period of electrolysis that precedes the reaction is attributed to the build-up of deuterium to the critical concentration in the regions around the dislocations or other defects in the palladium.

If, during the period before the experiment commences, hydrogen has diffused into the palladium and segregated to the dislocations, there will be fewer lattice interstitial sites into which the deuterium can migrate when electrolysis in heavy water commences, and the deuterium concentration around the defects may never attain a high enough level for the 'fusion' reaction to start.

If this hypothesis is correct, it accounts for the failure of some laboratories to produce the 'fusion' reaction described by Fleischmann and Pons[2]. The solution is to purify the palladium before electrolysis so as to remove hydrogen and any other interstitial atoms that, by segregating to the crystal defects, prevent the critical

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Efforts abandoned in Japan

Tokyo

NEWS of cold fusion has caused wild excitement in Japanese laboratories, but so far all attempts to replicate the work have failed. Some researchers have already abandoned their efforts and, whatever might be said in US congressional hearings, there are no government plans to support a national research project.

Within days of the announcement by Utah research groups that they had achieved fusion in a flask, a broad-based effort to replicate the experiments began in dozens of laboratories around the country. Japanese scientists took to the research with the same unbridled enthusiasm they showed following the discovery of high-temperature superconductors two years ago. But this time all there is to show for their efforts is one false alarm.

On 1 April, Japanese newspapers reported that Noboru Oyama of Tokyo University of Agriculture and Technology had observed large amounts of heat and gamma rays when an electric current was passed between palladium and platinum electrodes in heavy water.

But Oyama says the press reported only the "positive" aspects of his results. Subsequent experiments in collaboration with researchers at the Japan Atomic Energy Research Institute have failed to detect emission of neutrons, tritium or helium-4. And calorimetry experiments will not be completed for several months, Oyama says.

Other groups with expertise in nuclear fusion and neutron detection report similar negative results. And a group at Hokkaido University headed by Hiroshi Ohashi announced a few weeks ago that it was abandoning its experiments because of failure to detect any products of nuclear fusion.

Nevertheless, interest in government and industry remains high because Japan, which depends on imports for most of its energy, would stand to gain enormously if cold fusion turned out to be a practical source of energy. And several symposia on cold fusion will be held over the coming weeks.

But, in contrast to the case of high-temperature superconductors, no government ministry or agency has established or plans to establish a 'study group' (*kenkyukai*) of industrialists and academics to promote national research on cold fusion.

Cold fusion still needs to be proved says Shigeharu Kato, deputy director of the Technology Development Division of the Science and Technology Agency's Atomic Energy Bureau, an organization that oversees Japan's research development of nuclear fusion.

David Swinbanks

18 May

lescence (K. Lam, Royal Postgraduate Medical School, London). This finding is consistent with the notion that EBV infection, together with malaria-associated T-cell immunosuppression, provides an exceptional reservoir of infected B cells in which a c-*myc* translocation could occur. The T-cell response affected by malaria is apparently directed at several of the viral genes expressed in cells immortalized *in vitro*. Cytotoxic T-cell clones that recognize B cells immortalized only by strain A of EBV, but not by strain B, have been shown to recognize two viral proteins (EBNA-2 and EBNA-3A) found in the nucleus. These findings come from experiments performed by introducing expressed viral genes from strain A that encode these nuclear proteins into B cells immortalized by strain B that are not recognized by the T-cell clones and finding that the recipient B cells subsequently are targets for killing (D. Moss, Queensland Institute of Medical Research). As long as these gene-transfer experiments do not affect the expression of relevant surface molecules of the major histocompatibility complex, they indicate that T-cell recognition of EBV-infected cells could be similar to the recognition of influenza-infected cells[4]. Biopsies of Burkitt's lymphomas often do not express EBNA-2 or EBNA-3A[3] and thus could escape the T-cell recognition described by Moss.

The expression of EBNA-2 in cells has been found to increase the expression of another viral protein, latent membrane protein, which itself can induce the expression of several activation antigens (S.D. Abbot, University of Birmingham; E. Kieff, Harvard Medical School). This protein is often not found in biopsies of Burkitt's lymphomas[3], in agreement with the failure of these lymphomas to express B-cell activation antigens.

A candidate for a cell in which c-*myc* translocation to an immunoglobulin locus can occur has been identified as an EBV-immortalized pro-B cell derived initially by infection of cells from fetal liver[5]. These cells yield different translocations involving the immunoglobulin H locus on propagation in culture (E. Altiok, Karolinska Institute). They also express B-cell activation antigens and at least seven EBV proteins. If they do represent the virus-infected precursor of a Burkitt's lymphoma, then development of this tumour will probably involve the loss of expression of activation antigens and some viral proteins during differentiation.

This proposed complex role for EBV in carcinogenesis will require further diverse tests before it serves as a thesis to be reconciled with new and differing views. Evidence for the association of the virus with B-cell lymphomas in transplant recipients and in people with AIDS has accumulated and indicates its direct role in carcinogenesis in severely immunocompromised hosts (D.H. Crawford, Imperial Cancer Research Fund, London; G. Lenoir, IARC, Lyon). By contrast with Burkitt's lymphoma cells, these tumour cells express both activation markers and at least eight viral proteins. This direct role of EBV lends support to the notion that it contributes causally to Burkitt's lymphoma. Its role in Burkitt's lymphoma may eventually be substantiated by testing in people a vaccine that has been found to protect New World monkeys from developing lymphomas following intravenous administration of EBV (M.A. Epstein, University of Oxford). □

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No new fusion under the Sun

ELECTROCHEMICALLY induced fusion[1,2], now a subject of popular debate, is not a new notion. In the 27 April issue of *Nature*, extracts were printed in the News and Views section[3] from the debate surrounding the claim during the 1920s of Peters and Paneth[4,5] that ordinary hydrogen absorbed in palladium fuses to form helium. In his news story in the same issue[6], Steven Dickman mentioned contemporary work of Tandberg at the Electrolux laboratories in Stockholm, which resembles closely the recent work, involving electro-chemical cells and the release of heat. My father, Torsten Wilner, worked with Tandberg in this and other nuclear research. I still have their notes which are a source of fascinating insights.

Tandberg's introduction to this work was indirect: he started in 1925 by trying to find metals suitable for sealing hydrogen in refrigerators. He became interested in palladium, but for its contrary properties — its permeability and large absorption capacity for hydrogen. He was struck by the work of Paneth and Peters[4,5], who were attempting to produce helium — for use in airships — by the "spontaneous nuclear catalysis" of hydrogen atoms in palladium metal, and who expected heat to be produced, although they did not pursue this aspect. As noted in Dickman's report[6], the helium that they identified spectroscopically was in fact atmospheric, not the product of any nuclear reaction.

Tandberg followed up this work, using electrolysis to concentrate hydrogen at the palladium surface — effectively generating a high hydrogen pressure, he argued. The main benefit was to be the generation of energy: the original title of Tandberg's 1927 patent application for the process was "A method for the release of atomic energy", although this was later altered to "A method for producing helium", possibly as a concession to the patent office.

The patent was not granted, the main reason given being Tandberg's failure to answer the office's objections: what is "hydrogen of highest concentration"?; the mechanisms for the extraction of energy needed better explanation; and the description was not sufficiently complete for a competent person to use the invention. After the discovery of deuterium in 1932, however, Tandberg and Wilner repeated the experiment, now using heavy water, probably supplied by Niels Bohr.

Their enthusiasm for fusion fired, the two continued with experiments using exploding wires, an approach now used in some laboratories to accelerate ions to sufficiently high energies to overcome Coulomb repulsion. High-voltage capacitors were discharged through thin palladium rods saturated electrolytically with deuterium. On the night of the first discharge, Tandberg asked my father to leave so that he would be able to report what had happened in the event of a nuclear explosion. Nothing spectacular did happen, although the noise of the discharges became a feature of the laboratory routine. No clear-cut results were obtained, possibly because good diagnostic techniques were not then available. I still have the notes and letters referring to the experiments, and some specimens of palladium rods and heavy water. All of these should be studied carefully.

Tandberg and Wilner continued their nuclear experiments in the basement of my father's home. They reproduced the famous experiments of Cockroft and Walton, artificially transforming ^{7}Li into two α-particles by acclerated protons. In a subsequent experiment, bombarding a deuterium-saturated palladium sheet with accelerated deuterons[7], they observed the fusion reaction of such interest now: $d + d \rightarrow {}^{3}He + n$. The product neutrons were slowed by paraffin wax and detected by the activation of silver. (Much of this work is discussed in a book written to celebrate Tandberg's versatility and achievements[8].) Bertil Wilner

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lished Fig. 1*a*, thereby not providing the supporting evidence of the ^{40}K (1.46-MeV) and ^{208}Tl (2.61-MeV) features which must be present in their spectra in order for their identification to be correct.

Therefore, although Fleischmann *et al.* may have observed a change in their γ-ray spectra that bears some relation to detector location, we conclude that it is unrelated to the 2.22-MeV neutron-capture γ-rays, and that it is also unrelated to the background $^{214}_{83}$Bi line (2.20 MeV; Fig. 1*a*), as has been suggested elsewhere[11]. We can offer no plausible explanation for the feature other than it is possibly an instrumental artefact, with no relation to a γ-ray interaction.

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Fusion in from the cold?

SIR—Recent experiments involving the loading of deuterium (D) into palladium[1] via a 0.1 M $LiOD/D_2O$ electrolyte may have created something not encountered in the absence of current flow. The voluminous body of older work on electrolytic D–Pd loading is based on thin wires or foils of high aspect ratio which allow only small voltage differentials. But the reported chemical potential across a thick deuterated palladium negative elctrode could give rise to metastable solid phases alien to the existing equilibrium Pd–D phase diagram. The theoretical existence of palladium analogues to hydrogen-rich[2] compounds like Li_2ReH_9 is as tantalizing as the limit of solid solubility of D in Pd is finite. And beyond PdD_3 (by analogy to the known compound Li_3Pd) the thermodynamic distinction between the higher palladium deuterides and metallic deuterium grows dim. The mechanism of their formation might involve the intersection of high deuteron mobility grain boundaries with the Cottrell clouds of H and D that decorate dislocations in many transition metals.

A small mass of (mostly) deuterons transforming into molecular deuterium as they recapture electrons previously delocalized into the S- and D-bands of palladium could release roughly 1 MJ mol^{-1}. Apart from explaining the electrode meltdown and vaporization reports[1] (although this could be due to lithium's remarkable ability to lower the melting point of palladium), this could raise local temperatures to very high values.

Could the so-called 'cold fusion' environment in fact involve local temperatures of greater than 10^5 K generated by the detonation of deuteron clusters (R. G. Gordon, personal communication) or of a metallurgical precipitate, coarse or fine-grained, of a high D/Pd ratio intermetallic compound inside a deuterated palladium electrode? The energy of reassociation of electrons and deuterons is roughly 1 Rydberg (13.6 eV) minus the work-function of Pd (4.9 eV); to this must be added the roughly 4.7 eV liberated when two deuterium atoms pair. Obviously, these energies must be scaled down to compensate for the difference between reactions in free space and the solid state. Nevertheless, the 20 eV energy of formation of D_2 from deuterons could thus produce hot and highly compressed deuterium plasma bubbles of small ($>0.01\mu m - <100\mu m$) size. As to the objection that the surrounding cool metal will quench these bits of pale fire in a nanosecond or so, I believe it answers a serious question: how come the Fleischmann and Pons[1] claimed neutron yield is 9–14 orders of magnitude short of their claimed heat flux? At present, one can only speculate as to by how many orders of magnitude a reflected spherical shock front might raise the temperature and pressure of the D-plasma.

There is another ramification to the notion of nano-novas flashing out of perdeuteride grains decorating the grain boundaries of electrochemically overwrought palladium nagative electrodes. The explosion of such precipitated grains will, above a critical radius, generate cracks in the adjacent metal. It has been postulated (G. Chapline, personal communication) that the surfaces of such cracks, as they open, could host a field gradient or a propagating array of plasmons down whose wake field a deuteron could accelerate. This presumes that the bulk Pd–D system has reached 1:1 stoichiometry and thus been restored to long-range order; this condition is very far from the disorderly and anharmonic state of Pd–D during the early stages of electrolytic D-loading. In this model some thousands of unit cells of travel would suffice to yield keV deuterons. So the propitiated shade of Rutherford may yet countenance not-so-cold fusion.

It has been noted in a News and Views article in the 27 April issue[3] that neutrons have been observed when cracks are generated in crystals of lithium deuteride[4].

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Mössbauer cancer therapy doubts

SIR—Mills *et al.*[1] present data to support the view that a dose of 10^{-5} Gy of 14.4-keV X-rays can ablate a population of malignant cells containing ^{57}Fe(III) · bleomycin. They suggest that such a regime may have the potential for the low-dose sterilization of superficial human tumours.

This is unlikely on simple physical grounds, basically because only a small fraction of the exposed cells will have received any energy deposition at all. The proportion of cells that would receive one or more energy depositions, assuming the statistical independence of such events, is obtained from the Poisson distribution and is $(1 - e^{-n})$; here n, the average number of energy depositions occurring in the sensitive site, is given by D/z_{1F}, where D is the absorbed dose and z_{1F} is the so-called 'frequency-averaged specific energy per event' — or simply, the mean energy per unit mass deposited by single energy deposition events in the sensitive site in the cell[2]. This mean specific energy will be similar, irrespective of whether the photon is ultimately absorbed in a photoelectric event or in a Mössbauer absorption (it would be slightly larger in the latter case); it has been measured for 12-keV photons in a tissue-equivalent material in spherical sites of various volumes[3].

Appropriate volumes for consideration are those of typical human cell nuclei (100–1,000 μm^3)[4] or, perhaps more relevantly, the volume of nucleotides in the mammalian nucleus (~3 μm^3)[5]. For volumes of 250 and 3.5 μm^3, for which measurements have been made[3], the corresponding values of z_{1F} are 4×10^{-3} Gy and 0.14 Gy. These numbers yield a probability of about 2.5×10^{-3} that a 250 μm^3 volume of cell nuclei will be subject to at least one energy deposition, and a corresponding probability of 7×10^{-5} for a 3.5 μm^3 volume of nucleotides. Thus, only about 1 in 400 cells (250 μm^3 volume) or 1 in 14,000 cells (3.5 μm^3 volume) would receive any energy deposition at all if exposed to a dose of 10^{-5} Gy.

To sterilize even a small tumour containing about 10^8 cells requires an appropriately small probability (less than 10^{-9}) that any cell will receive no energy-deposition events. Thus, an average number of energy depositions per cell of

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Cold Water on Cold Fusion

By George Chapline

LIVERMORE, Calif. Two chemists, Stanley Pons at the University of Utah and Martin Fleischmann at the University of Southampton, England, startled the world this spring with an announcement that they had achieved nuclear fusion at room temperatures. As evidence, they cited the production of "excess" amounts of heat in an electrochemical apparatus and the observation of neutron production.

While the production of heat in a electrochemical apparatus is not in itself unusual, the observation of neutrons is extraordinary. The presence of neutrons would indicate that nuclear reactions are taking place.

Unfortunately, their announcement has led to widespread confusion. Measurements of the neutron production in an apparatus similar to that used by Dr. Fleischmann and Dr. Pons has been carried out at dozens of laboratories. These experiments have shown that the neutron production fails by many orders of magnitude to support the Fleischmann-Pons assertion of having discovered a cheap source of fusion power.

In particular, independent measurements of the neutron production rate suggest that the actual rate of fusion energy production probably does not exceed one trillionth of a watt. The neutrons reported by various laboratories may or may not represent an interesting discovery. In any case, they don't represent an immediate and cheap source of electricity.

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The behavior of the Utah chemists is deplorable.

Actually, Dr. Fleischmann and Dr. Pons acknowledged in their first press conference that there was a serious discrepancy between the observed number of neutrons produced and their claim of having produced useful amounts of fusion energy.

They explained this discrepancy by suggesting that the excess heat was due to a new kind of fusion reaction. However, to date they have presented *absolutely* no evidence that their excess heat is due to fusion reactions.

In fact, their evidence for any excess heat at all is very suspect. With few exceptions, attempts by reputable laboratories to duplicate the Fleischmann-Pons experiment have failed to find any evidence of excess heat. And, to my knowledge, no laboratory has produced incontrovertible evidence that fusion reactions are responsible for the heat observed.

What about the theoretical possibilities for cold fusion? Simple quantum mechanical calculations that any physics graduate student could do show that the probability of fusion in a deuterium molecule is more than 50 orders of magnitude too small to explain the heat reported by Dr. Fleischmann and Dr. Pons.

Of course, the conditions of deuterons inside a palladium electrode are somewhat different than those in a deuterium molecule. However, there is no reason to believe that the probability of fusion is significantly higher than in a deuterium molecule.

On April, 14 the Massachusetts Institute of Technology released a statement that declared that an associate professor of electrical engineering, Peter Hagelstein, had developed a theoretical explanation for cold fusion. However, examination of his papers reveals that his theory is not a theory at all in the usual sense.

Professor Hagelstein proposes that two deuterons can fuse to form helium, with the energy released directly in the form of heat, but he proposes no physical mechanism to explain how this can happen.

Apart from whatever it is that Dr. Pons and Dr. Fleischmann may or may not have discovered, their behavior is deplorable. At any time in the past month, they could have submitted the electrodes in their apparatus for an independent analysis of their helium content. As helium is the main product of the purported fusion reaction, this analysis could have dispelled many doubts. Their failure to submit the electrodes for analysis leaves one wondering what is happening at the University of Utah.

This brings one back to the question of whether there is any "excess heat." In 1823, a German chemist, Johan Dobereiner, discovered that palladium will spontaneously catalyze the oxidation of hydrogen. He used this discovery to make a device he called a Feuerzeug, a precursor to the cigarette lighter. Several groups attempting to duplicate the Utah experiment have noticed that if the level of electrolyte drops too low, the palladium electrodes become red hot. Thus, it is possible that Dr. Fleischmann and Dr. Pons have rediscovered a 150-year-old German lighter.□